RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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GENERAL INFORMATION

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The Radiologist—Some of His Problems

Presidential Address[1]

WARREN W. FUREY, M.D.

Chicago, Ill.

THE HIGH POSITION of radiology among medical specialties is something of which we in the field can be justifiably proud; that position, however, is not entirely an enviable one. The growth and development of the science, so familiar to all of you, have been nothing short of phenomenal, yet with that growth has come an ever-increasing complexity of the many problems confronting those of us who have chosen this as our life's work.

The mechanical and technical difficulties of the early days have long since ceased to cause much serious concern. The attempts of lay laboratories to practise medicine through radiology have been fairly well overcome, although still somewhat of a problem in some centers; and protection against the hazards of the rays, once an enigma, is now a procedure of accepted routine.

Today's radiologic problems are of a different nature and spring both from within and without the specialty.

Intraradiologic problems that plague us have as a common denominator the variance in the economic and social structures within which radiology is practised. These are private office practice, practice limited to hospitals, clinic group practice, combinations of these, and complete occupation in the educational field. We find it vexatious at times to reconcile the divergent individual attitudes produced by these differing professional environments. This is the main circumstance that calls for mental adjustments within the radiologic family circle. Just as every family has its differences that necessitate give and take, so does radiology. We need not, however, apologize to any group for our conduct in reconciling these differences. The family has remained intact, preserved by our intellectual comradeship, our devotion to our professional purpose—better radiology for all—and our recognition of the primary ethic: "Do unto others as you would have others do unto you."

It would be pleasant to be able to render the same sort of report on our problems that arise outside the specialty. That is not possible at this time. Perhaps I should have used the singular and said "problem" rather than "problems." For, though it appears in many guises, our fundamental problem is the attempt on the part of some hospitals, aided and abetted to an extent by certain hospital groups, to control the practice of radiology by treating it as a hospital rather than a medical service. This is aggravated by the provisions of certain Blue Cross contracts which

[1] Delivered before the Thirty-sixth Annual Meeting of the Radiological Society of North America, Dec. 10, 1950. Chicago, Ill.

guarantee in the name of cooperating hospitals to provide radiologic service, rather than offering an indemnification. Parenthetically, this aggravation will remain with us until Blue Shield plans more universally include adequate radiologic service.

We may take comfort in one fact. While at first glance our problem seems unique, it is but an extension of the over-all problem facing the entire medical profession—the escape from outside domination. Note that I say "domination" and not interest, co-operation, or even influence.

Living as we do in a nation that is health-conscious to an extent unprecedented in the history of the world, we must expect to feel the impact of the public on our methods of practice and way of life. Practising as many of us do within the physical and social structure of the hospital, we must expect constantly to be made aware that we are part of a co-operative venture to safeguard, preserve, and advance the health of the public. We must, however, be constantly on our guard to escape domination. Let us be influenced but not controlled, for a man cannot well serve two masters. Our professional status lies in the fact that we are devoted to but one master—the patient—to the exclusion of all others. And we must not let any man, government, group, corporation, or other entity violate this pact. We in radiology by historical and economic circumstances are the men in the foxholes of the battleground of corporate practice. Arrayed directly behind us are our colleagues in medicine, and farther back is the civilian population—the American patient-public—we mean to protect.

When I say this, please believe that there is no intent to throw new fuel on what is already a fire that threatens to get out of hand. National consideration of local problems by both hospital and radiologic groups pulling in opposite directions has already been the cause of much confusion. There have been charges and countercharges; tempers have become frayed; at times there has been a great danger that the patient—the one individual to whom both groups are responsible and to whom they have dedicated their services—would be forgotten. Continuation of such a practice would lead but to one thing: the ultimate loss of faith on the part of the patient in both the hospital and the physician. This is something that none of us wants to see.

Most radiologists have little or no difficulty in dealing with the individual hospital administrator or with the hospital staff. Considered at the national level, however, the local problem rises to great proportions and sometimes appears impossible of solution.

We often wonder why it is that certain individuals with outstanding qualities of leadership, yet sometimes adamant in attitude, can and do dominate many fields, often to the discomfort and distress of others in the field. This is not peculiar to medicine nor to hospitals. The same applies to Blue Cross-radiologist relationships. In some places the two are working peacefully; in other instances they just manage to get along, while in many cases there is open hostility. Given the answer to why this occurs, the problems created by the situation would tend to disappear. The tragedy is that all of these things are happening at a time when both groups should be co-operating toward a common goal: service by all to the patient at a cost he can afford to pay; service rendered under the freedoms presently enjoyed in our country. Both radiologists and hospitals must recognize that these freedoms will not long be enjoyed if we continue to find ourselves fighting not only the social planners and the do-gooders who would change our way of life but one another in a battle that potentially can destroy both of us. Give a little, take a little, and the solution to our problem may not be as impossible as it appears.

This brief summary of the large problem that confronts us is not by any means a complete discussion of our present situation; rather it is a comment on a few of the close, rather personal difficulties that most affect us and certain other medical spe-

cialties but which, unfortunately, are showing increasing signs of involving the practice of medicine as a whole.

The ultimate solution appears to rest with our continuing effort in the cause of medicine generally. American medicine today finds itself in a fight for existence. Political pressure, social changes, increasing costs of everything, so-called poor distribution of physicians over the country, unfounded claims of inadequate medical care for people in low and middle income groups, and selfish personal desires of some individuals high in government circles have been among the contributing factors to this present artificially stimulated demand for a change which can only spell domination.

You are all well aware of this pressing problem. We, as a recognized part of American medicine, have enjoyed the growing co-operation of American medicine. We should extend our fullest co-operation to those of our fellows who work with us. This co-operation of organized American medicine has been invaluable to us. Through it the seriousness of our special problems has been recognized by the vast majority of physicians, as evidenced by the long study of our position by the House of Delegates of the American Medical Association. Every session of that body over the past several years has dealt with one or more resolutions pertaining, directly or indirectly, to our specialty, and in each instance we have won friends and gained increasing support. A recent action of the House of Delegates has brought forth what has come to be known as the Hess Report. This report, approved at the meeting in San Francisco in June 1950, represents an attempt to solve the problem of hospital-physician relationship. It is not everything that many in our group would like; it is, however, a partial answer to the question and a sincere expression of support. It should go a long way toward improving our position in hospital relations.

The report as finally approved was the culmination of many years of careful study by different committees of the House of Delegates of the American Medical Association brought about by the annual presentation of resolutions pertaining to the problem. Its final approval was not attained without considerable difficulty. The last hurdle, however, was cleared, and the report is now a part of the official records of the Association.

As it now stands, the report contains a Preamble which gives a brief account of the activity of the House on the matter during 1949 and 1950. It then discusses the law and ethics involved in the problem and contains the statement: "In addition to being guided by the laws of the various states, physicians in their relationship with hospitals must be guided by the Principles of Medical Ethics of the American Medical Association." Pertinent chapters of these Principles are quoted, followed by a presentation of the duties of the Judicial Council as outlined in the Constitution and Bylaws of the Association. This section provides the teeth for enforcement of the recommendations of the report, covered by the following quotations: "The Council shall have jurisdiction on all questions of medical ethics and the interpretation of the laws of the Association..... The Council may acquit, admonish, suspend or expel the accused..... If and when a physician is found to be unethical by the proper authorities as established through channels specified in the Constitution and Bylaws, and he is still retained on the staff of any hospital approved for resident or intern training by the Council on Medical Education and Hospitals, it shall be the duty of the Judicial Council to request conference with the Council on Medical Education and Hospitals on the advisability of removing such hospitals from the approved list under the assumption that the hospital is just as unfit for the training of young physicians for unethical reasons as it is unfit because it may not or does not have proper filing systems for its laboratory or clinical records."

Further in the report the Committee, recalling past actions of the House of Delegates, reiterates that "radiology, anes-

thesiology, pathology, and psychiatry constitute the practice of medicine," and notes that the House of Delegates has in the past stated: "If hospital service is limited to include only hospital room accommodations, such as bed, board, operating room, medicines, surgical dressings, and general nursing care, the distinction between hospital service and medical service will be clear." This is followed by a recommendation that "Blue Cross and Blue Shield co-operate to the extent of writing all new contracts in such a manner that Blue Shield will cover insurable medical services and Blue Cross will cover insurable hospital services." The final chapters of the report provide for its activation, with suggestions that physician-hospital problems be resolved in so far as is possible, first at the staff-management level, then if that is unsuccessful, with the assistance of the appropriate committee of the county medical society, next the state medical association, and finally the Judicial Council of the American Medical Association.

As a result of the recommendations of the report, state and county medical societies are appointing Committees on Hospital and Professional Relations to assist in solving disagreements that may arise. You, as members of organized medicine, are urged to co-operate with your county medical society, your state medical association, and the American Medical Association in this effort to improve physician-hospital relationships, with the hope that both groups can, as they should, render the best quality services possible to the public. It is also hoped that the stand represented by the report will serve as a deterrent to further encroachments of hospitals or other lay groups in efforts to enter the practice of medicine. As a point of commendation, one might add that the active individual participation of many radiologists in the affairs of the House of Delegates has been largely responsible for our favorable consideration, and this favorable consideration will be continued only so long as we contribute our share to the over-all effort of American medicine. In pursuing our radiologic affairs, we should not lose sight of the fact that what affects medicine affects us, because we are part and parcel of medicine just as are the general practitioner, the internist, the surgeon, and all the others of our great profession. Our problems are their problems and their problems are ours. This is something of which we should never lose sight.

How then can we do our bit in the campaign for medicine? The answer lies in continuing our effort to solve our own problems and the problems of medicine as a whole—not only in our personal interest but in the interest of all physicians, our patients, and theirs. We must continue to strive to make good our claim that the American public is today enjoying the highest type of medical service available anywhere in the world and to convince others that the present high plane is a result of a free and undominated medical profession.

In this effort, American medicine has had and will continue to have a terrific struggle. We have for the past two years been engaged in a tremendous program of public education instigated and financed by all of us through the American Medical Association. This campaign was initiated at a time when it appeared that the American way of life as we have known it was to be discarded, to be replaced by the Utopia envisioned by both the day-dreaming do-gooders and their fellow travelers. The propaganda emanating from these star gazers and malcontents sought to engulf an unsuspecting public in a scheme to regiment medicine through the program of compulsory health insurance. The scheme was extolled as the panacea for all human ills and frailties and was promised at a cost that could be easily and painlessly met by all. It offered all things to all men, in spite of an unbroken record of shortcomings, failures, deterioration of medical service, and excessive cost in every country in which the program has been tried. This program of fact distortion has been countered by the National Education Campaign

of the American Medical Association. The Association has used every possible means to convey the true picture of American medical activities and achievements to the American people. Radio, television, news releases, pamphlets, editorials, personal contacts, talks and speeches to groups of all sizes, and finally a tremendous national advertising campaign last October are some of the means which have been used to bring the truth of our position to every part of our country.

The favorable reaction to our cause has been clearly shown through the resolutions condemning socialized medicine, by whatever name you choose to call it, adopted by thousands of organizations large and small, local, state, and national, over the country. We as organized physicians are prohibited by law from furthering our cause through active participation in political campaigns. The American Medical Association as a medical society can neither support nor oppose candidates for federal office. Endorsement of candidates involving expenditure of general corporate funds, contribution of funds to any candidate for federal office, using medical society letterheads or facilities to advance work in behalf of a candidate, and sponsoring any other form of advertising material for a candidate are also barred according to an interpretation of the federal statutes by the law firm of Kirkland, Fleming, Green, Martin and Ellis rendered at the request of the American Medical Association's National Education Campaign Committee.

As individuals, however, we are citizens, and as citizens we enjoy the rights and privileges of our fellow Americans. As such we can and did actively support candidates who supported us, and we actively opposed those whom we felt were not sympathetic to our cause. We did urge everyone to register; we did encourage everyone to vote; we did inspire doctors to exercise their rights of franchise and, in many sections of the country, we exercised the privilege of individuals to form Political Action Committees. Through these means we, as Americans, were able openly and legally to state our position, to urge the support of our fellow citizens, and to participate actively in the campaigns for legislative offices. The success of this part of the program was clearly demonstrated in many primary campaigns and in the national election on Nov. 7, 1950.

As physicians we have accomplished a partial victory over the socializers in this the negative phase of the campaign; our cause has won much support and we should feel highly encouraged by the results. We have not in any sense completely eliminated the threat of regimentation. We are merely enjoying a respite, a breathing spell to permit preparation and realignment of our forces for the greater fights that face us in the future. The planners have not and will not quit.

So much for the negative side. Ahead of us is the large and truly constructive program of the positive phase of the campaign. This has tremendous possibilities and offers a real challenge to medicine. Evidence of this activity was clearly shown last week at the Clinical Session of the American Medical Association in Cleveland. Two entire days of the meeting were devoted to improving public relations, and it was most impressive. The report of the Council on Medical Service dealt with these problems and offered recommendations for their solution and for their extension and implementation. These were approved by the House. One very positive step was the constructive action of the Board of Trustees, unanimously concurred in by the House, initiating the move to set up a fund to aid in the cost of medical education through private rather than governmental sources by placing $500,000 in that special fund. It was important not only to further medical education but to show the public that we in medicine are ready and willing to do our part to preserve the American way of life.

In closing, I should like to leave with you the thought that we, as individuals and as a specialty group, have problems which are

serious to us and, because of that, serious to medicine generally and—more important—serious to the American public. In view of this we should strive to solve our own difficulties not in any limited way but as an integral part of the American medical profession in the interest and welfare of our patients, the great American public.

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SUMARIO

El Radiólogo: Algunos de sus Problemas

El problema fundamental que confronta a la radiología como especialidad en los E. U. A. es el empeño de algunos hospitales, secundados hasta cierto punto por ciertos grupos hospitalarios, de regir el ejercicio de la radiología, tratándola como servicio hospitalario más bien que médico. Esto no es más que una fase del problema que encara a toda la profesión médica, o sea el peligro del dominio por extraños. La solución definitiva parece descansar en el continuo esfuerzo en pro de la causa de la medicina en general. Abógase por la colaboración con las asociaciones locales y estatales de medicina, y con la Asociación Médica Americana, a fin de mejorar las relaciones entre médicos y hospitales y prestar servicios de calidad óptima al público. Bosquéjanse algunas de las providencias ya tomadas.

Can Voluntary Insurance Do the Job?[1]

LOWELL S. GOIN, M.D.

Los Angeles, Calif.

MY SUBJECT IS stated as a rather simple and innocent question: "Can voluntary insurance do the job?" Its simplicity is more apparent than real and, if it is to be answered intelligently, it must be looked at rather closely. If you were to ask an engineer whether a 60 H. P. tractor would do the job, he would at once inquire "what job," and he might even ask you why the job needed doing.

We may assume that the question posed in my subject means the job of giving medical care to the people. You will note that I say "giving medical care" to, and not "caring for the health" of our people. I am constantly amazed at the little attention paid to the obvious fact that "health" and "medical care" are not synonymous terms. Medical care is the care of the sick and injured. Health is the state of not being sick or injured, and it depends almost entirely on such factors as an adequate diet, proper clothing, good housing, adequate recreation and rest, safety factors, sanitation and hygiene, and the control of patent medicines and cults. Medical care is only a fraction, and not even the most important fraction, of the whole problem of health.

But why is there a job to be done? To this there are two possible answers. The first is unacceptable to the proponents of national health insurance, which is said to be the only possible alternative to voluntary insurance. The second is, or should be, totally unacceptable to all Americans who believe in free enterprise and who view with alarm the so-called welfare state.

The first answer is that there are a good many people who recognize the sometimes catastrophic nature of illness or accident, who realize that medical costs are unpredictable, and who prefer to budget themselves to provide for medical care (I include hospitalization) when it is needed. The second answer is that our national health is so bad that it is a national menace and that only national health insurance can fill the extremely urgent and pressing need.

I should like to digress for a moment to speak briefly of semantics. As you all know, semantics is that division of thought which deals not with the dictionary meaning of words, but with their impact on the consciousness. As an example, let me cite the recent inept fumbling, by the President of the United States, with the welfare clause of the Constitution as a justification for the welfare state. Let us consider those words that have an enormous significance in the subject under discussion. The first is *planning*. Now "to plan" means, to most of us, so to arrange and employ our skills and our resources that we may most efficiently accomplish our desired objective. But, suddenly, the words do not mean that: they mean the conscious direction of all human activity by a central planning board. You will see the significance of this when you consider how difficult it would be to argue that it is wrong to plan when your opponent is employing the words in their first sense. "Health" is a so-called favorable symbol. Everyone is in favor of health, virtue, Whistler's mother, and the national anthem. Everyone is against disease, sin, and infamy. Let us, therefore, always employ the word "health" and speak of "health needs," "health problems," and "health insurance." Insurance, too, is a favorable symbol. To most of us it represents prudence and foresight, and a proper regard for one's loved ones. No one likes taxes, so let us say insurance and let us couple it with health. Then we can say "health insurance" and not "sickness tax." Thus, people will not

[1] Read before the Thirty-sixth Annual Meeting of the Radiological Society of North America, Dec. 10, 1950, Chicago, Ill

notice that so-called national health insurance is in no sense insurance and that it has practically nothing to do with health.

Well: To return to our question and its two possible answers: If it is true that our national health is pretty bad, that many people are unable to secure medical care, that people can't afford to pay for medical care, and that national health insurance would cure these evils, it will be pretty difficult to argue in favor of voluntary methods. If all of these claims should prove, on examination, to be untrue, then we are justified in looking into the motives of those who so vigorously advance them.

Very briefly let us consider whether they are true, and let us take these claims directly from the source book. On Sept. 2, 1948, there appeared (carefully timed to make the headlines over Labor Day weekend) a book by Mr. Oscar Ewing, Federal Security Administrator. It is called "The Nation's Health, A Report to the President." You will assume at once, of course, that Mr. Ewing is an outstanding authority on health problems, but you will be slightly disappointed when you learn that Mr. Ewing is a lawyer who for four years was Vice-Chairman of the Democratic National Committee. No doubt this is excellent training for high public office, but I think it of rather dubious value as training for an expert in health problems. On page 1 of Mr. Ewing's book is a smashing and dramatic statement: "Every year 325,000 people die whom we have the knowledge and the skills to save." Totally neglected is an obvious truth. Neither the medical profession nor anyone else has the knowledge or skills to prevent the death of even one person. All will die. At the best, we can change the cause and the date of death. Let us look at the figures. Of the 325,000 people, Mr. Ewing says, 170,000 die of communicable diseases, and of these we should save 120,000. Just how, or just why 120,000, he doesn't say—obviously the inference is that it will be by means of national health insurance. The facts aren't quite in agreement with the statement. In 1945 (the year quoted) 177,000 people did die of communicable disease, but in 1947, without the benefit of Federal intervention, this figure had been reduced to 137,000—a reduction of 40,000. No mention is made of this. As a matter of fact, the management and control of communicable disease is almost entirely a function of the various public health departments and, health insurance or not, must continue to be, since the rest of us must be protected from contagion.

Next, Mr. Ewing says, 600,000 die every year from cancer and heart disease, and of these we should save 115,000. This, of course, is a figure pulled out of a hat, and no evidence for it is adduced. But the figure is a curious and interesting one, and deserves a little close inspection. It is not broken down into deaths from cancer and deaths from heart disease, but the latter is the number one killer and I think it would be fair to assume that 400,000 of the 600,000 died of heart disease. If lack of medical care is responsible for these deaths, it should be reflected in the death rates of various regions and should be definitely related to the quality, quantity, and availability of medical care. Yet seven of the nine states with the highest death rate from heart disease were in New England. The six states with the lowest death rate were in the deep South. New England has infinitely more doctors, hospital beds, clinics, research centers, and economic resources in general than the deep South. Why didn't they manifest themselves in a lower death rate? The answer is plain: Medical care has nothing to do with the problem.

So much for the superficial and fallacious arguments of the social planners.

How is our health? Well, it's excellent. It's the best in the world. We have conquered smallpox, typhoid, typhus, malaria, yellow fever, and diphtheria. We have drawn the fangs of pneumonia and many other killers. When I was a young doctor, the mortality of lobar pneumonia was perhaps 40 per cent. Now it is perhaps 1 per cent. In my youth, a male child at birth had a reasonable expectancy of living

thirty-nine years, but at present the expectancy is about fifty-nine years and that of a female infant sixty-five years. The incidence of tuberculosis in the United States is less than 25 per 100,000 population. In Great Britain, it is more than 50 and less than 75 per 100,000. In France, it is more than 75 and less than 100, and in Russia it is more than 170 per 100,000. Longevity is increasing steadily; so much so that our senior population is becoming a serious problem. Does this sound like very bad national health? What, then, is all the shouting for? National health insurance, better called national compulsory sickness tax, is a planned and integral part of the socialist-welfare state, and its enactment into law would be a definite step and, indeed, one of the final steps, on the dreary road that leads to national socialism.

We may now return to the alternative answer to the question, why is there a job? The answer is a simple and logical one. There are people who prefer to protect themselves against the sometimes catastrophic costs of medical care by budgeting. And now the final question: Can voluntary insurance do the job? Of course it can. It is doing it, and with a considerable degree of success.

The reformer argues that a relatively small number of people are now cared for by voluntary plans, ignoring the plain fact that we are caring for none by federal compulsory plans. It is an easy and natural thing to ignore, or to attempt to ignore, an unpleasant truth, and hence no reference is made to the fact that millions of Americans are now providing themselves with prepaid medical and hospital care by means of voluntary plans, and that the only actuarial knowledge extant concerning health insurance concerns such plans. No one knows what the cost of compulsory health insurance will be, and estimates vary widely. The costs of voluntary prepayment plans are known, and as experience develops, the costs may be reduced, the service expanded, or both. Any changes in a compulsory plan, once it is established by law, will be made with great difficulty, as the most casual perusal of the daily paper will indicate.

Let us now consider some of the objections to voluntary health insurance. Those most commonly urged are: (1) An insufficient number of people are covered. (2) People will not provide themselves with voluntary coverage. (3) The existing plans do not offer complete coverage. (4) Preventive medicine is not sufficiently emphasized. (5) Protection of the citizens' health is a natural function of government.

(1) It is true that not nearly as many persons are covered as would be covered by a national compulsory plan. But does this mean that people should be compelled by law to do something for their own protection—something that they thus far seem not to be persuaded is essential? As experience develops, as an increasingly large number of subscribers are protected, will not these (if they are satisfied with their coverage) urge their friends and relatives to buy voluntary insurance protection and, if the plan is bad, will it not fall of its own weight? Why, then, must we suddenly impose a new, untried, and highly experimental plan upon the American people? If voluntary insurance proves inadequate or unsatisfactory, it may be terminated at any time by those who are insured, since, if they become dissatisfied, they will simply cease paying for unsatisfactory service. All experience, however, indicates that a compulsory plan, once enacted into law, is never repealed, but is only compounded by amendments, executive orders, and decrees.

Specifically, what is offered to the American people? There are a variety of plans offered, each filling some part of the general need. There is no perfect plan. Perhaps there will be, but it will require time and actuarial experience to develop it. At the moment nearly 50 million people have insurance in the Blue Cross Plans which protect them against hospital expense. Thirty-four million more have medical and surgical or surgical expense contracts which protect them against medical and surgical costs.

(2) To the argument that not enough people will protect themselves without compulsion there are two answers. Seventy-one million of our people have protected themselves with life insurance which they bought and continue to pay for of their own free will, simply because they have been persuaded as to the necessity of so doing. Of course, this vast number of insured was not reached in the first few years of selling insurance, nor should we expect tremendous numbers to enroll themselves in health insurance plans until educational campaigns have had an opportunity to persuade them, and if, after such opportunity has been afforded, people still decline to buy health insurance, will it not indicate their disinclination to budget themselves for medical care, either voluntary or compulsory? And are we not still free men capable of deciding for ourselves without the intervention of an all-wise government?

(3) Existing voluntary plans do not offer complete coverage (although some of them approach it rather closely), nor does the currently proposed compulsory plan, in spite of claims to the contrary. Complete coverage is not yet offered because we simply do not know how to do it, nor do those who demand enactment of compulsory insurance. Many voluntary plans offer full coverage less a few restrictions which are necessary to protect the plans from frank imposition, but which could scarcely be held to be a very serious obstacle to obtaining medical care. Little as the compulsory insurance proponents say about it, an identical provision is contained in the Murray-Wagner-Dingell Bill. Complete coverage will be offered by voluntary plans as soon as the necessary experience has accumulated. Without experience, it cannot be offered, nor can the necessity for experience be by-passed by writing a law.

(4) Preventive medicine is a phrase much beloved by the social reformer, who seems to have a child-like faith that a visit to the panel practitioner will prevent disease. The hard fact is that medicine has not yet attained to the wished for goals, and that most talk about preventive medicine is wishful thinking. How shall we prevent heart disease (except that due to rheumatic fever)? What examination today makes one aware of the coronary disease impending? How do we prevent cancer of the stomach and intestinal tract? The plain hard answer is that there is no such examination, and that we do not know how to prevent cancer, and yet these are the two greatest killers that we know. Moreover, it will be well to know how compulsory health insurance proposes to accomplish miracles in preventive medicine. There are two references to the matter in the pending legislation: One authorizes grants-in-aid to research institutions, and the other directs that the administration of the law shall be such as to prevent accident, disease, and premature death! A consummation devoutly to be wished, but a typical example of the type of thinking that leads to compulsory health insurance, *i.e.*, write it down in a law and it's accomplished.

(5) That the protection of the health of the citizen is a natural function of government is debatable. The best government is that which governs least, and all history persuades us that freedom is smothered by increasing government paternalism.

What have the voluntary plans to offer? Service varying from almost complete (*i.e.*, two visits deductible) to that covering only catastrophic illnesses. Not every one has need of the same amount of service; the voluntary plans afford to each the chance to select that which he requires. Nearly seventy voluntary plans are now in effect, not including the large amount of indemnity sickness and accident insurance which is written annually by the commercial companies. These plans offer their insured the opportunity to select the doctor of their choice, to go to the hospital which is preferred and, in general, to receive medical care of like quality and under the conditions to which they are accustomed. No administrative officer intervenes; no permits are needed; the relationship between the doctor and patient remains the

personal and confidential one of the past. No panels are formed; no one's permission is needed to choose a doctor or to change doctors if the patient is dissatisfied. That compulsory sickness insurance can or will permit these freedoms is simply not true, as any one can persuade himself by reading the bill now in committee in the Senate.

Another argument is that people just can't afford to pay for medical care. Medical and hospital bills are troublesome. So are rent and grocery bills, and the payments on the family automobile. How difficult is it? The fact is that the American people can pay for medical care if they only are willing to assign it a sufficiently high priority in their budgeting. Last year they spent about three billion dollars for medical care and hospitalization, including money spent for patent medicines and for cults. They also spent nearly four billion dollars for tobacco; 9.4 billion dollars for movies and other entertainment; 9.6 billion dollars for alcoholic beverages. The people have decided the priority they assign to the costs of medical care. It is their right to do so, and if a government can force them to assign some other priority, it can, with equal force and reason, compel them to change all priorities to conform with the opinions of some government agency. Is voluntary care so expensive? California Physicians' Service offers a surgical contract, a protection against catastrophe, for $2.00 monthly for a male and $2.80 for a female. This and all contracts include hospital coverage. It offers a medical and surgical contract, affording complete coverage except for the first two visits of the doctor, for $3.15 for a male and $3.80 for a female. It offers a medical and surgical contract to an employed person, with a surgical contract for his wife and any number of children, for $7.95 per month. This is about one and one-third packages of cigarettes daily; it is only slightly more than one neighborhood movie per week for a man, his wife, and one child. It may be worth noting that proposed national health insurance is not exactly free. Mr. Ewing estimates that it would cost 3 and perhaps 4 per cent of annual earning up to $4,800. If we take $3,600 as a sort of mean, 3 per cent will be $108.00 and 4 per cent will be $144.00 per year. The most expensive coverage offered by California Physicians' Service is slightly under $96.00 per year.

Voluntary health insurance, if given the opportunity to do so, untrammeled by governmental regulation and bureaucratic red tape, will give to the American people more medical care, and much better medical care, than can ever be furnished by politically managed compulsory plans. Moreover, it will do so in the American tradition, without the suppression of part of our freedom, and without offense to our American dignity. That its growth has been slow is to be expected. Evolution is a much slower and less dramatic process than is revolution, but the evolutionary product is the sounder one. Voluntary plans are being developed slowly, although as rapidly as may be (nearly seventy are now in existence in thirty states) on sound actuarial bases, by men who know that the complex and vexing problems of medical care are not to be solved by writing words and making them into laws.

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SUMARIO

¿Puede el Seguro Voluntario Resolver el Problema?

Al preguntarse si el seguro voluntario puede resolver el problema, el A. se refiere al problema de proporcionar asistencia médica a la gente. Después de bosquejar y refutar los argumentos de los defensores del seguro nacional de la salud (o sea, dicho con mayor propiedad, impuestos nacionales contra la enfermedad), dedúcese que: el seguro voluntario de la salud, si se le permite hacerlo, sin trabas gubernamentales

ni restricciones burocráticas, suministrará al pueblo de los Estados Unidos más, y mucho mejor, asistencia médica, que la que jamás pueden facilitar los planes obligatorios dirigidos por la política. Además, lo hará en las tradiciones del país, sin la supresión de parte de nuestras libertades y sin ofender la dignidad de los ciudadanos. Era de esperar que su desarrollo fuera lento. La evolución es un sistema mucho más lento y menos teatral que la revolución, pero el producto de la primera es el más sano. Los planes voluntarios van en desarrollo lento, pero lo más rápidamente que cabe (ya hay casi setenta en existencia en treinta estados del país) sobre sólidas bases actuarias, a cargo de sujetos que saben que los complejos problemas de la asistencia médica no se resolverán con la mera escritura de frases, trocadas luego en leyes.

The Anatomy of the Bronchopulmonary Segments: Clinical Applications[1]

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ONE OF THE PURPOSES of this report is to illustrate the various sublobar bronchopulmonary segments as they are outlined by disease and to demonstrate the changes in size, configuration, and position which various pathological processes may induce in them. It is our further and more important aim to show how such anatomical knowledge influences considerations of differential diagnosis, prognosis, pathogenesis, and therapy. The report is a continuation of a recent discussion (12) of the roentgen patterns and appearance of lobar collapse.

Except for some bronchoscopists and thoracic surgeons, the medical profession as a whole has not realized the value of a precise knowledge of the anatomy of the bronchopulmonary segments. We believe that an accurate understanding of bronchopulmonary anatomy is essential for the intelligent interpretation of abnormal shadows seen on plain roentgenograms as well as bronchograms. The young radiologist should *begin* his training in diseases of the chest with a study of the bronchopulmonary anatomy. He should not defer it to a later time, when set habits and patterns of interpretation have been acquired. He should be taught to regard each abnormal shadow as an anatomic as well as pathologic problem. Thus he will gain a logical approach to the problems of roentgenologic examination of the chest. The use of such loose descriptive terms as "root fan," "root triangle," "root shadow," "hump shadow," "hand shadow," "Anspach's triangle," etc., should be discouraged. Any abnormal shadow should be described in precise anatomical terms which accurately locate the disease.

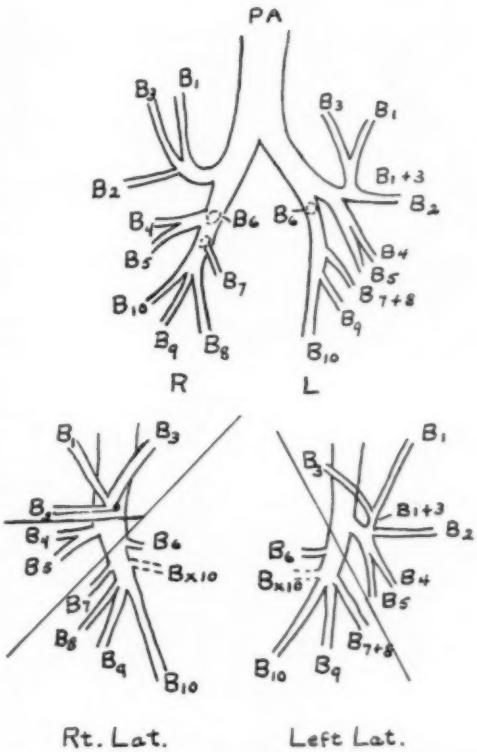


Fig. 1. Simplified diagrams presented merely as an index to the points of origin and direction pursued by the first sublobar bronchi. These can be used as a guide in studying the bronchograms presented. The reader is referred to the excellent colored drawings in Brock's monograph for a complete and accurate portrayal of the bronchial anatomy.

ANATOMICAL CONSIDERATIONS

Among the chief contributors to our present knowledge of bronchopulmonary anatomy are Brock (5), whose excellent monograph is written from the surgeon's point of view, Foster-Carter and Hoyle (7), Jackson and Huber (10), Robbins and Hale (18), and Boyden, Scannell *et al.* (4), who

[1] From the Department of Radiology of Mount Sinai Hospital of Cleveland, Herbert A. Mahrer, M.D., Chief. Accepted for publication in June 1950.

TABLE I: BRONCHIAL NOMENCLATURE
(See Text)

Brock	Jackson and Huber	Boyden
	Left Upper Lobe	
	APICO-POSTERIOR	B_{1+2}
APICAL	Apical subsegmental	B_1
Apical	Apical	B_{1a}
Anterior	Anterior	B_{1b}
PECTORAL	ANTERIOR	B_2
Axillary	Posterior	B_{2a}
Anterior	Anterior	B_{2b}
SUBAPICAL	Posterior subsegmental	B_3
Posterior	Posterior	B_{3a}
Axillary	Apical	B_{3b}
SUPERIOR LINGULA	SUPERIOR LINGULA	B_4
INFERIOR LINGULA	INFERIOR LINGULA	B_5
	Right Upper Lobe	
APICAL	APICAL	B_1
Anterior	Anterior	B_{1a}
Apical	Apical	B_{1b}
PECTORAL	ANTERIOR	B_2
Axillary	Posterior	B_{2a}
Anterior	Anterior	B_{2b}
SUBAPICAL	POSTERIOR	B_3
Posterior	Posterior	B_{3a}
Axillary	Apical	B_{3b}
	Middle Lobe	
LATERAL	LATERAL	B_4
MEDIAL	MEDIAL	B_5
	Left Lower Lobe	
APICAL	SUPERIOR	B_6
Superior	Superior	B_{6a}
Axillary	Lateral	B_{6b}
Paravertebral	Posterior	B_{6c}
SUBAPICAL	SUBSUPERIOR	B_x
ANTERIOR BASAL	MEDIAL BASAL ANTERIOR BASAL	B_{7+8}
MIDDLE BASAL	LATERAL BASAL	B_9
POSTERIOR BASAL	POSTERIOR BASAL	B_{10}
	Right Lower Lobe	
APICAL	SUPERIOR	B_6
Superior	Superior	B_{6a}
Axillary	Lateral	B_{6b}
Paravertebral	Posterior	B_{6c}
SUBAPICAL	SUBSUPERIOR	B_x
CARDIAC	MEDIAL BASAL	B_7
ANTERIOR BASAL	ANTERIOR BASAL	B_8
MIDDLE BASAL	LATERAL BASAL	B_9
POSTERIOR BASAL	POSTERIOR BASAL	B_{10}

have presented extremely detailed drawings of the bronchial anatomy. Other valuable papers have been written by Kramer and Glass (11), Adams and Davenport (1), Peirce and Stocking (16), Behr, Huizinga, and Pothoven (2, 9, 17), Neil, Gilmour, and Gwynne (13), and Blades (3).

The bronchial nomenclatures in most common use are those of Brock and of Jackson and Huber. Boyden's group has recommended a system of numbers and letters. In Table I are listed the branch bronchi which are important from a roentgenologic standpoint, as named by these three methods. Brock's terminology will be used in this report. It is simple, descriptive, and logical; the surface anatomical references allow easy commitment to memory. There is little difference between the methods of Brock and of Jackson and Huber. Boyden's numerical system lacks the descriptive qualities of the others and will be used in parentheses. Since the sublobar segments and the bronchi which supply them bear the same

names, the numbers will be used interchangeably.

It has not been found practical to pursue the nomenclature of the *basal* branches of the lower lobes beyond the first sublobar divisions. Elsewhere in the lungs the secondary sublobar divisions can and should be identified on bronchograms.

description of their position, boundaries, and borders. This is especially true if the *lateral* roentgenogram in each case is compared with the diagram of the segments of that lung (Fig. 2). By this method the reader will readily recognize the roentgen appearance of the segments.

It must be emphasized that the routine

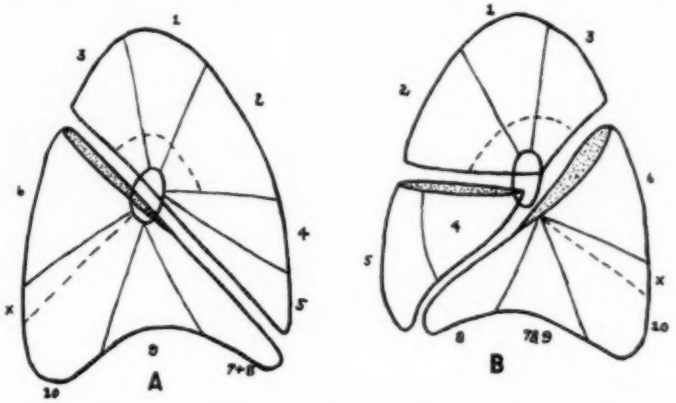


Fig. 2. These semi-exploded, schematic diagrams show the location of the bronchopulmonary segments as they are seen in the lateral roentgenogram. No attempt has been made to depict the surface anatomical areas of the mediastinal and lateral aspects of the lungs, since the lateral roentgenogram is two-dimensional. The variations between the two surfaces have been averaged to approximate the shadow-area a given segment would cast on the film. In the lateral view there is remarkably little superimposition of these segments which Foster-Carter and Hoyle have defined as "that portion of a lobe supplied by a principal branch of a lobar bronchus."

Since the segments resemble a series of triangles with the apices at the hilum, this is a simple way of remembering their position. There are only two important variations. One is the fact that the two segments of the middle lobe (B_4 and B_5), as seen in the lateral view, lie one behind the other. The other is the fact that the cardiac (B_7) segment overlies the middle basal (B_9) segment in the lateral view of the right lower lobe.

Most of the segments can be subdivided, but this is not usually practical on plain roentgenograms and is best done on bronchograms. However, the axillary subdivisions of the pectoral (B_{2a}) and of the subapical (B_{3b}) segments can be recognized and are indicated by dotted lines as suggested by Temple and Evans (19). The distribution of these two subsegments varies somewhat.

These diagrams and all lateral roentgenograms are reproduced so that the reader views them from the position of the tube and in the line of the roentgen ray as it passes through the body.

These diagrams should be used as a reference when the roentgenograms reproduced in this paper are studied. Identification of the segments as seen in the lateral view will be made much easier by such comparison. The numbers are those of Boyden's system. See Table I.

No attempt will be made to review in detail the studies of the anatomists, but line diagrams of the major bronchi (Fig. 1) are included for the purpose of reference to the bronchograms. To describe in detail the roentgen appearance of each segment would be needless duplication, since the accompanying roentgenograms illustrate these segments far better than any lengthy postero-anterior roentgenogram is entirely inadequate for the accurate localization of any lesion and for the differential diagnosis which must follow. This is true, even though Felson and Felson (6) have shown that one can frequently determine the anteroposterior position of a lesion on a single film if the shadow is adjacent to the cardiac or aortic borders. In such instances,

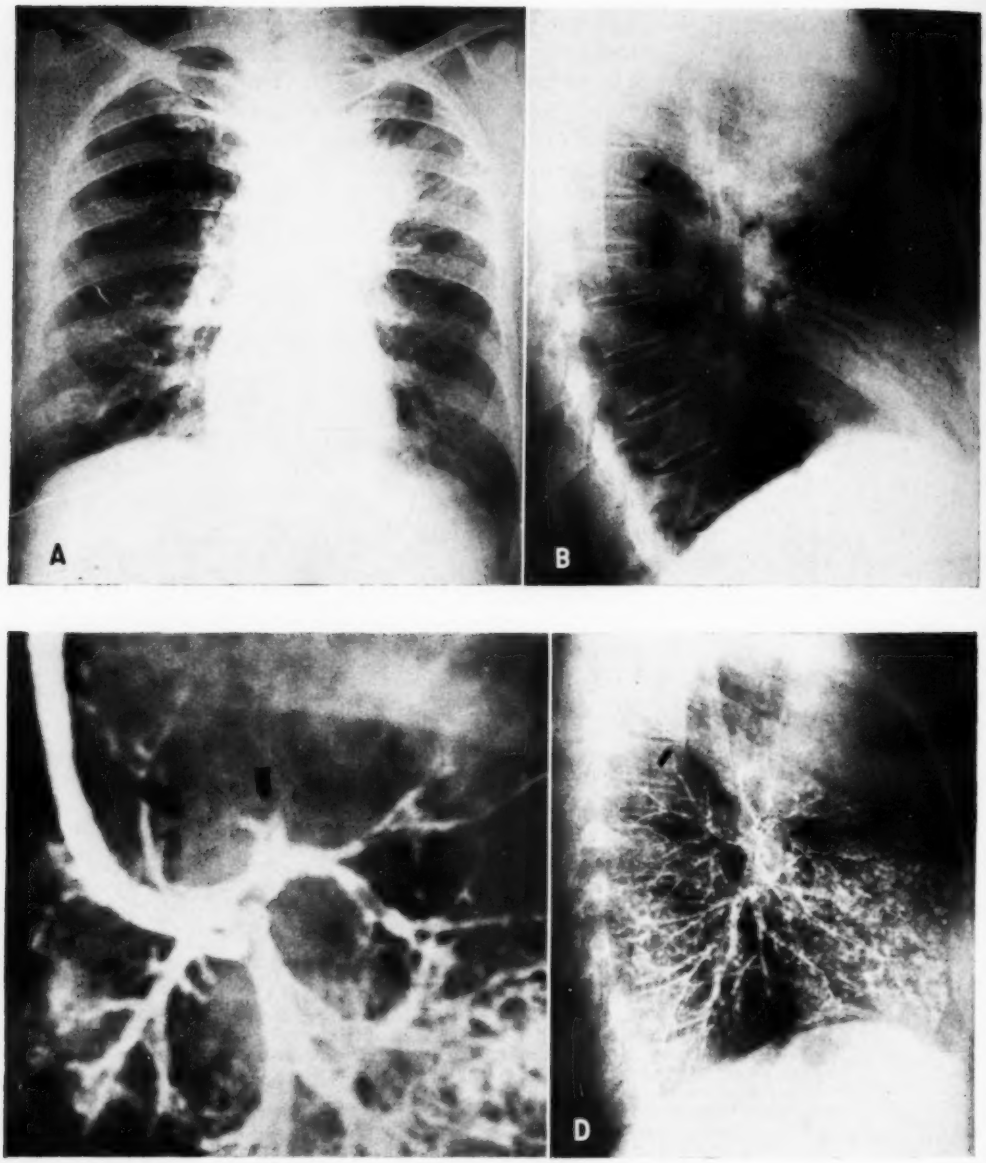


Fig. 3. Collapse of the apical (B_1), subapical (B_3), and pectoral (B_2) segments of the left upper lobe.

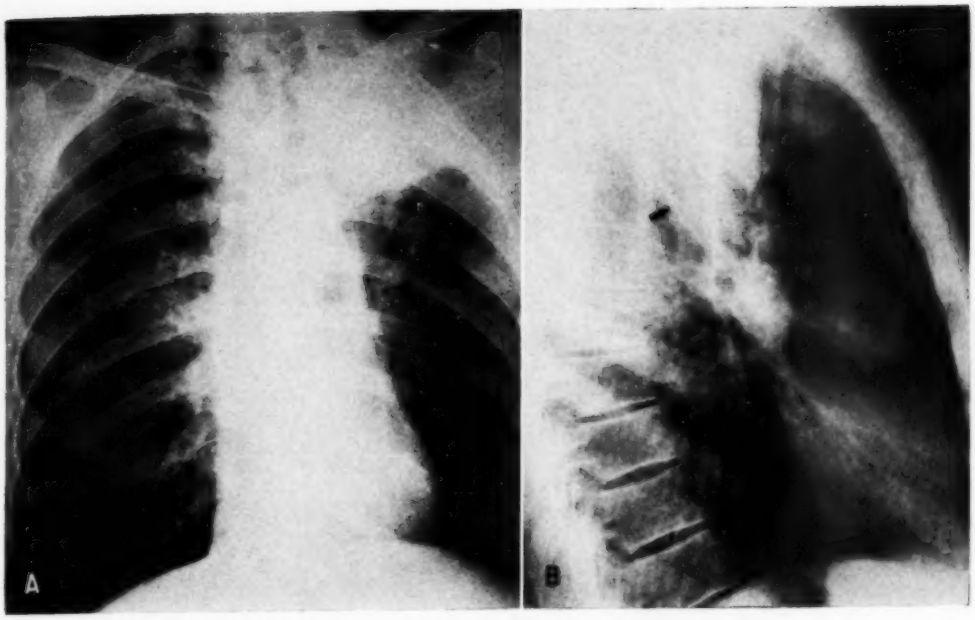
A. E., a 49-year-old housewife, complained of persistent boring pain in the left upper thorax for two months.

A. Postero-anterior view. Dense, homogeneous shadow extending outward from the upper portion of the left hilum.

B. Lateral view. The density is triangular and occupies the apex of the lung. It is sharply demarcated anteriorly and posteriorly and is clearly segmental. The absence of a downward tongue of density indicates that the lingula probably is not collapsed.

C and D. Bronchograms. The left upper lobe bronchus is blocked at a point just distal to the orifice of the lingular bronchus. The numeral 1 is placed between the branches of the apical bronchus of the lower lobe, and the numeral 2 between the branches of the lingular bronchus. These latter branches are retracted upward by collapse of the apical, subapical, and pectoral segments. The obstruction was due to carcinoma.

This is an example of collapse of all of the segments of the left upper lobe except the lingula. Compare with Fig. 4, which is quite similar but in which only the apical and subapical segments are collapsed.



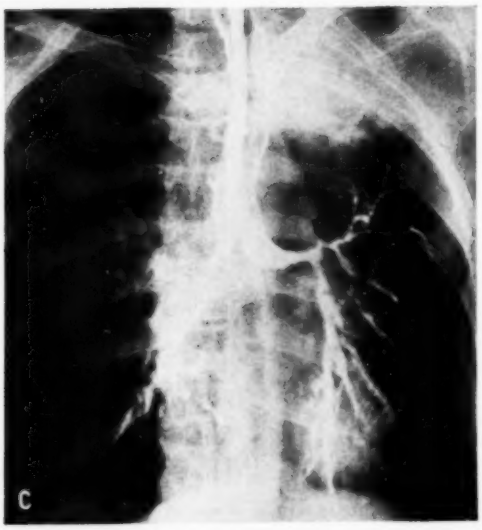


Fig. 4. Collapse of the apical (B_1) and subapical (B_2) segments of the left upper lobe.

E. M., a 56-year-old white male, had a history of "pneumonia" eleven weeks prior to admission.

A. Postero-anterior view. Homogeneous, sharply demarcated shadow of increased density in the left upper lung field; marked emphysema in the remainder of the lung and retraction of the trachea to the left.

B. Lateral view. The shadow is triangular in shape, is high in the apex, and does not have an anterior, downward tongue of density. It is, therefore, due to collapse of a segment or segments of the upper lobe.

C. Bronchogram. The left bronchus is retracted upward and has irregular margins. The numeral 1 is between the branches of the pectoral (B_2) and lingular (B_4 and B_5) bronchi. The arrow points to the obstruction at the common trunk of the apical (B_1) and subapical (B_2) bronchi. The shadow is thus identified as due to a collapse of these two segments. At surgery, a tumor which obstructed these bronchi, and which extended centrally under the mucosa, was found.

This case illustrates not only the collapse of these two segments, but also the fact the tumor soon would have caused complete lobar collapse. If the patient had been seen then, for the first time, the erroneous impression would have been gained that the tumor *arose* in the lobar bronchus.

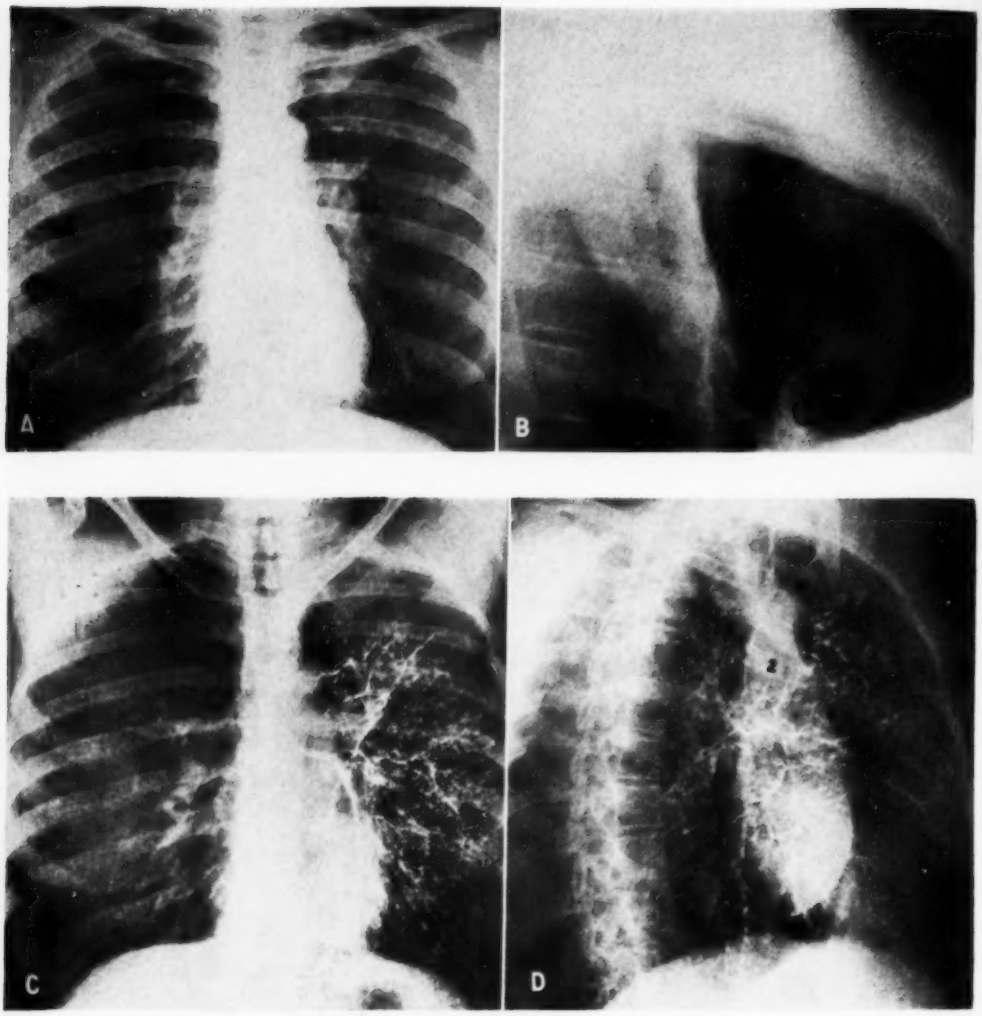


Fig. 5. Collapse of the subapical (B_2) segment of the left upper lobe.

D. L., a 31-year-old white female, had a history of repeated attacks of pneumonia and a chronic cough for three years.

A. Postero-anterior view. Irregular patch of increased density in the left subapical region.

B. Coned lateral view. The density is triangular, obviously segmental in character, but smaller than the subapical segment (B_2) usually is in that area.

C and D. Bronchograms. The bronchi are normal in caliber, but the lingular (B_4 and B_5) and the pectoral (B_2) branches are displaced upward. The numeral 1 has been placed between the lingular and pectoral bronchi. The numeral 2 is placed at the point where the subapical bronchus usually arises, but which is not filled. Arrows designate the density due to the collapsed subapical segment. Obstructive bronchiectasis was found in this collapsed segment.

In this case the lateral view clearly demonstrates the segmental character of the disease and the bronchogram shows the site of the occlusion.

the border of the heart or aorta is obliterated only if the disease process is in actual anatomic contact with the organ. Nevertheless, for accurate localization, a lateral projection is essential, and oblique views may be of help. The information supplied by bronchography crystallizes knowledge of the anatomy of the bronchopulmonary segments, so that, with increasing experience, it becomes easier to determine the

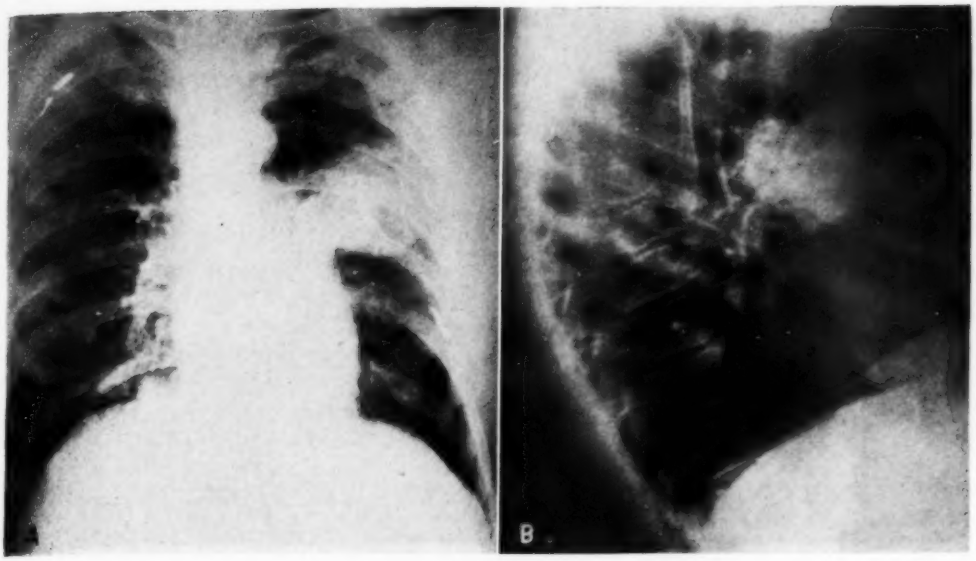


Fig. 6. Involvement of the pectoral (B_2) segment of the left upper lobe by primary tumor, proved at autopsy.
G. S., 45-year-old colored male.
A. Postero-anterior view. In the left mid-lung field there is a large, homogeneous dense shadow with sharply circumscribed borders. Numerous small, faint, discrete nodules are present in the right lung.
B. Lateral view. The large shadow in the left lung is anterior in position and therefore within the pectoral segment (B_2). This is obviously due to tumor, but the presence of numerous metastases on the right side prevented surgical intervention.

anatomical location of a diseased area on plain roentgenograms.

One important point in technic should be emphasized. The routine use of a stationary grid on all bronchograms and plain lateral and oblique projections, combined with higher kilovoltages, will yield radiographs of superior quality. The upper portions of the lungs can clearly be seen through the shoulder girdle, and the oil-filled bronchi are well delineated through the cardiac shadow. The use of a target-film distance of 4 feet for these projections will permit exposure times of one-tenth of a second or less. The slight magnification factor is unimportant.

Laminagrams and bronchoscopy are very important adjuncts in the diagnosis of lesions of the primary or of the lobar bronchi but are of less value in diseases of the sublobar branches.

APPLICATIONS OF ANATOMICAL KNOWLEDGE

Once the segmental character of a given shadow has been recognized, the size, variation in position, and location of that segment must be considered. The importance of this information goes far beyond mere localization for purposes of surgical resection. It is basic to an intelligent differential diagnosis and appreciation of the pathogenesis of the disease.

The *size* of a bronchopulmonary segment is of the utmost importance, even though there is known to be some normal variation. An abnormal density in the lung field that can be identified as a bronchopulmonary segment which is smaller than normal indicates the presence of collapse of that segment and probable bronchial obstruction. However, when a small subsegmental bronchus is occluded, the phenomenon of collateral air drift may prevent collapse of that subsegment (Van Allen and Lindskog, 20).

A collapsed segment represents a diagnostic and therapeutic emergency. If it is due to neoplasm, the chance of cure may be lost by delay. If the condition is benign, the presence of persistent bronchial ob-

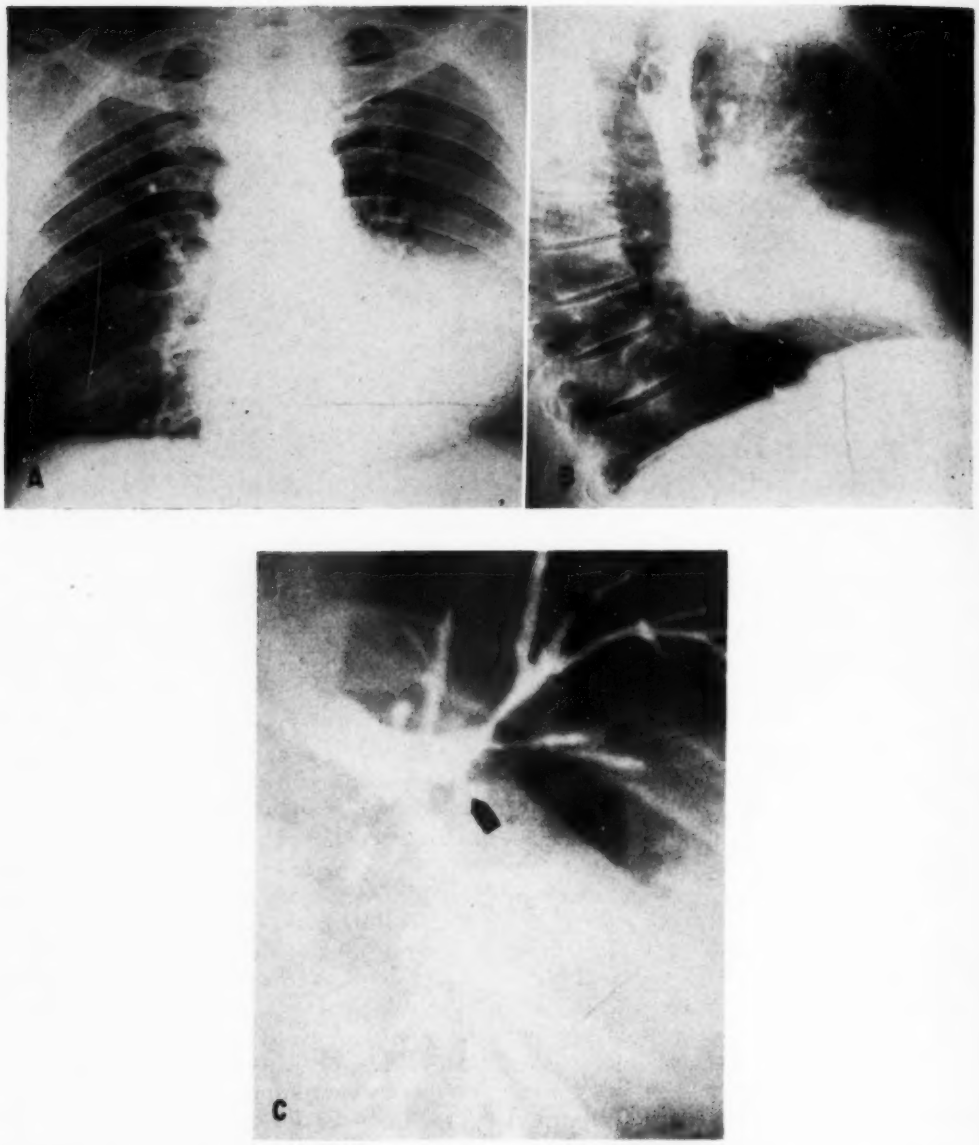


Fig. 7. The lingula (B_4 and B_5) of the left upper lobe.

D. V., a 62-year-old white male, complained of cough for six months, occasional streaking, and weight loss.

A. Postero-anterior view. Large, dense, rounded shadow in the lower portion of the left lung.

B. Lateral view. The shadow is anterior in position, in the lingula of the left upper lobe. Rounded borders near the hilum suggest that most of the shadow is due to a tumor, but the parallel borders peripherally indicate some collapse. Note that the lingula reaches the diaphragm anteriorly and thus appears in the lower portion of the lung field on the postero-anterior roentgenogram.

C. Spot film bronchogram. An excellent filling of all branches is seen, except for the lingula (arrow), which is occluded at the common orifice of the superior and inferior branches. The pectoral bronchus is narrowed. The two small branches seen just above the arrow are part of the apical bronchus (B_6) of the lower lobe. At surgery the occlusion was found to be due to carcinoma.

This case demonstrates the position of the lingula, which is best seen in the lateral view. The bronchogram proves the site of the occlusion.

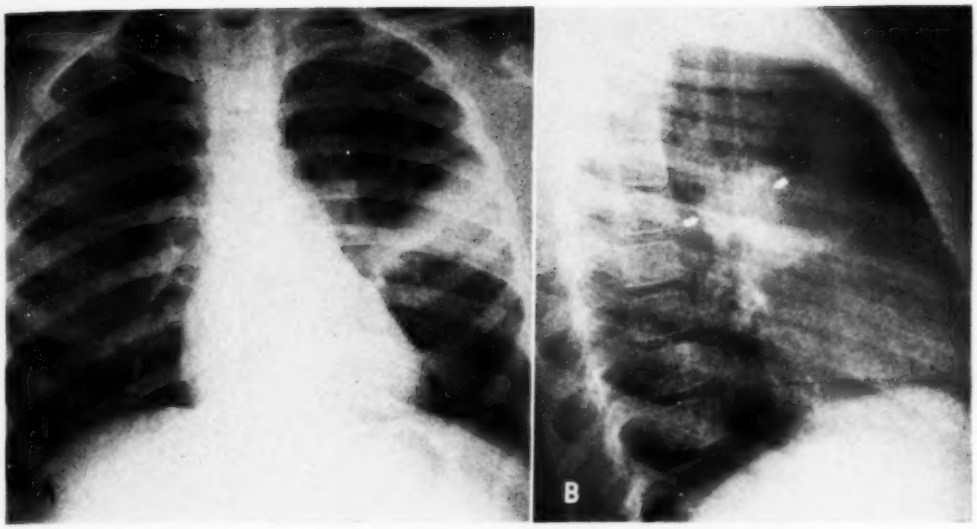


Fig. 8. The axillary subdivision (B_{2a}) of the pectoral segment of the left upper lobe.
P. J., an 8-year-old white girl, was admitted with a history typical of lobar pneumonia.
A. Postero-anterior view. Laterally placed homogeneous density in the left lung.
B. Lateral view. The shadow is slightly forward of the mid-axillary line and is, therefore, in the axillary subdivision (B_{2a}) of the pectoral segment (see diagram in Fig. 2).
This is an example of localization of lobar pneumonia to a single peripheral subsegment, yet one which can be clearly identified as a subsegment, even without bronchograms.

struction leads to a "drowned" segment, infection, and often bronchiectasis. Segmental collapse requires an accurate etiologic diagnosis by means of bronchoscopy, bronchography, laminagraphy, cytologic studies of bronchial secretions, or even surgical exploration. Figures 3, 4, 5, 9, 17, and 20 represent examples of collapse of a segment or group of segments.

Diminution in size of a segment is of importance in diseases of known etiology as well. For example, the prognosis and therapy of a tuberculous cavity may be entirely different if the pulmonary segment which contains it is partially collapsed as a result of tuberculous bronchitis. Diminution in size of a lesion does not necessarily mean improvement. It may be due to collapse secondary to bronchial disease. Lateral views should be taken more frequently in these patients, even though the etiology of the disease is known.

It is also possible for a partial bronchial occlusion to cause a relative increase in size of a segment when a check-valve mechanism exists and causes obstructive emphysema. This is best recognized on a pair of inspiration-expiration roentgenograms.

Some *change in position* usually occurs with diminution in size. The collapsed segment may be displaced by complementary emphysema of adjacent segments, or it may be retracted by fibrosis in the course of healing of an infarct or inflammatory lesion.

The *location* of a lesion in the lung is of considerable although not specific diagnostic import. Lung abscess and tuberculosis are known to be more frequent in those segments which are dependent in the supine and lateral positions—subapical segment of the upper lobe (B_3) and apical segment of the lower lobe (B_6). Pneumonia and carcinoma, on the other hand, are likely to be found in almost any position in the lungs.

While we realize that every attempt should be made to reach an etiologic diagnosis in all cases, nevertheless, the presence of a shadow of unknown cause in an anterior segment (except the middle lobe)

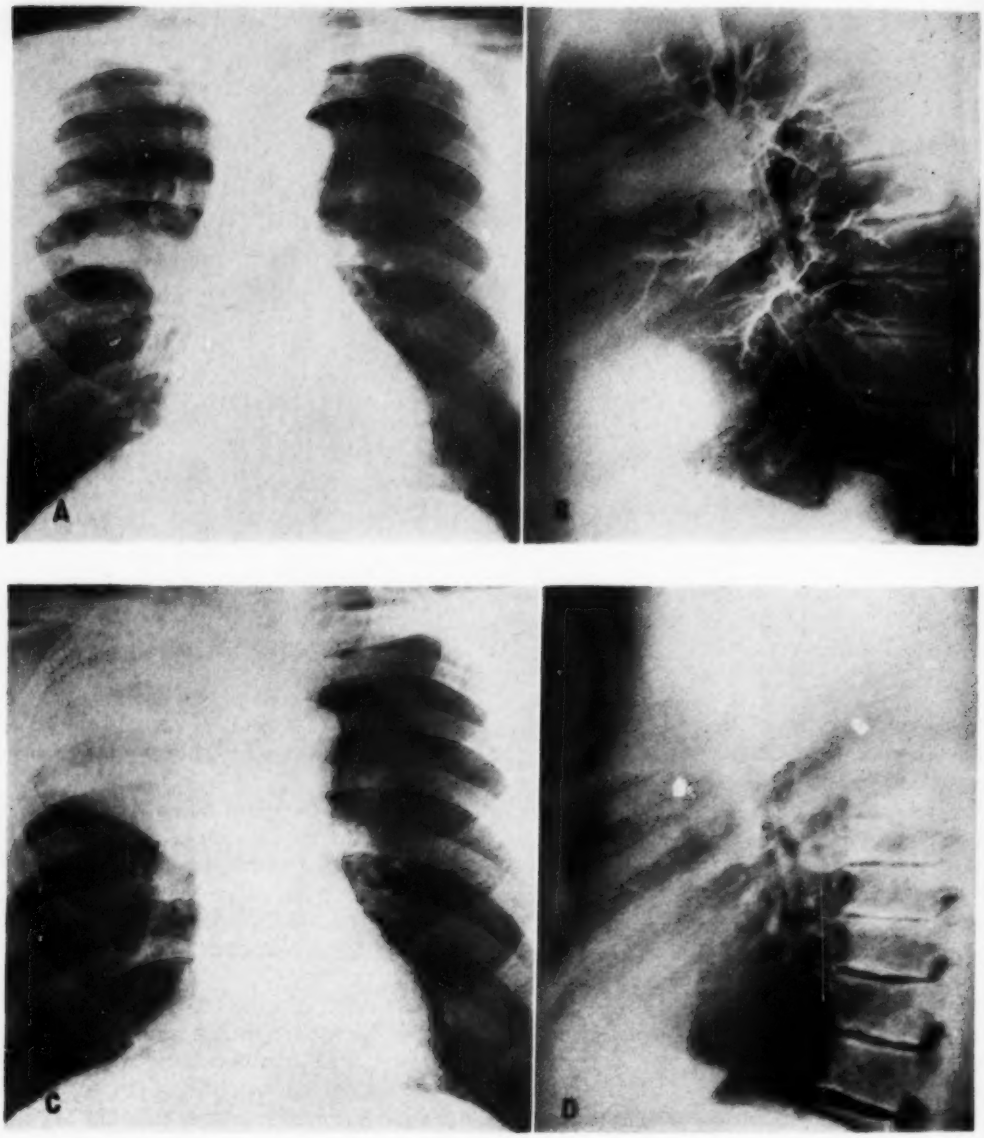


Fig. 9. The pectoral (B_2) segment of the right upper lobe.

G. S., a 62-year-old white male, was first admitted to another hospital with a history of cough and blood-streaked sputum of two months duration.

A and B. Original postero-anterior and lateral views. Dense shadow in the right upper lobe anteriorly in the pectoral segment. The interlobar septum is curved upward and the segment appears to be smaller than normal (arrow). The pectoral bronchus is not filled. In spite of the roentgen diagnosis of bronchial occlusion and segmental collapse, the patient was discharged because the bronchoscopic examination was negative. He was readmitted five months later.

C and D. Postero-anterior and lateral views. Complete opacity of the right upper lobe with slight retraction of the lobe toward the apex. Pneumonectomy confirmed the original roentgen diagnosis of carcinoma.

Had this patient been seen for the first time with the complete lobar collapse, the tumor would have been regarded as arising in the lobar bronchus, whereas the evidence shows that the origin was in the pectoral bronchus, with subsequent centrad extension.

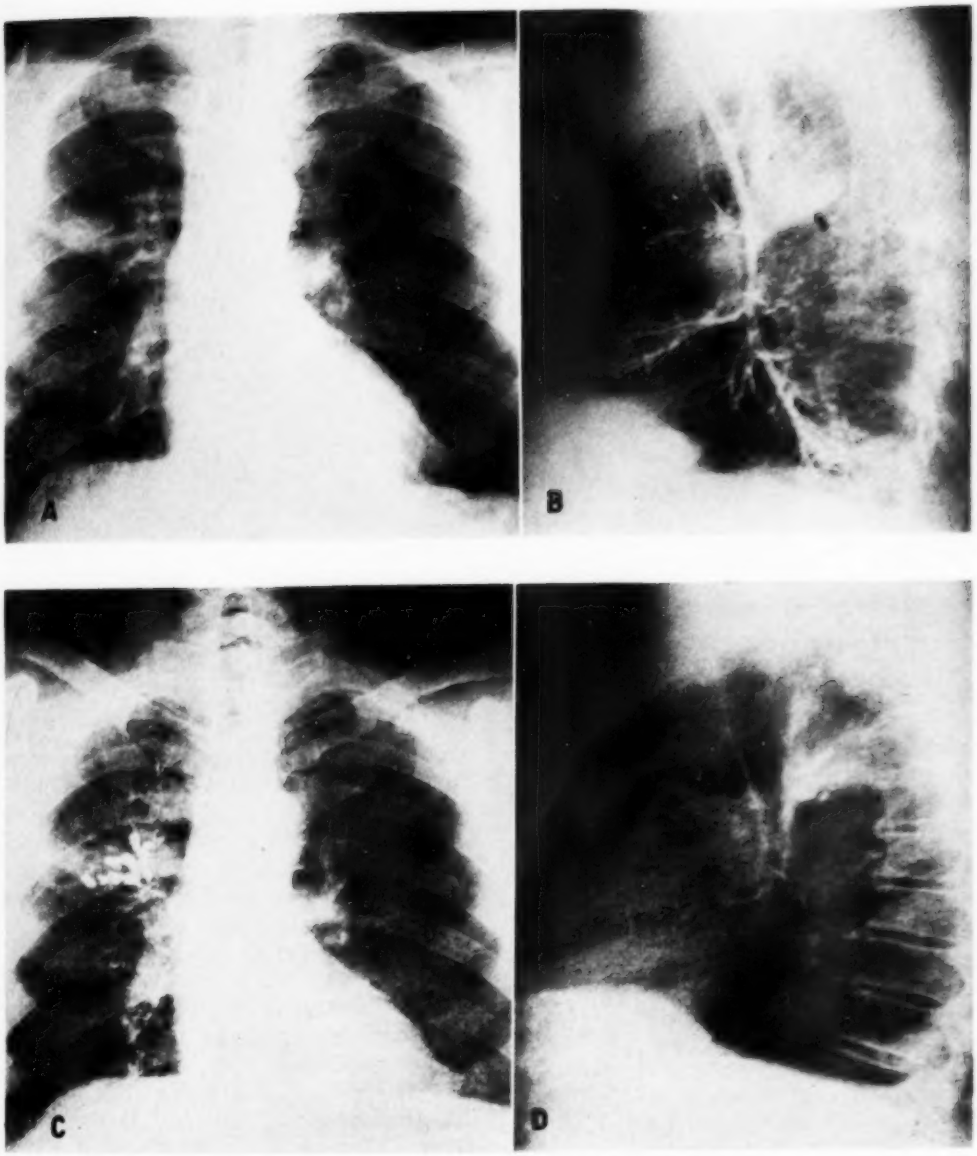


Fig. 10. The subapical (B_3) segment of the right upper lobe.

E. S., a 56-year-old white male, had a history of cough for several months, recent blood-streaked sputum, but no weight loss.

A. Postero-anterior view. Confluent and streaked mottling in the right mid-lung field without cavitation, which in the lateral view was found to be posterior in position, in the subapical (B_3) segment. Because of the posterior location, inflammatory disease was regarded as more likely, and several sputum examinations were made. These were negative for tubercle bacilli.

B. Lateral bronchogram. Normal filling of the apical (B_1) and pectoral (B_2) branches, but no filling of the subapical branch (arrow) in the area of disease.

C and D. Repeat bronchograms one month later. Excellent filling of the subapical bronchus is seen. There is obvious cylindrical and saccular bronchiectasis.

This is an example of segmental bronchiectasis, intermittent occlusion of the subapical bronchus, and only slight diminution in the size of the segment. The characteristic posterosuperior position of this segment in the lateral view is demonstrated.

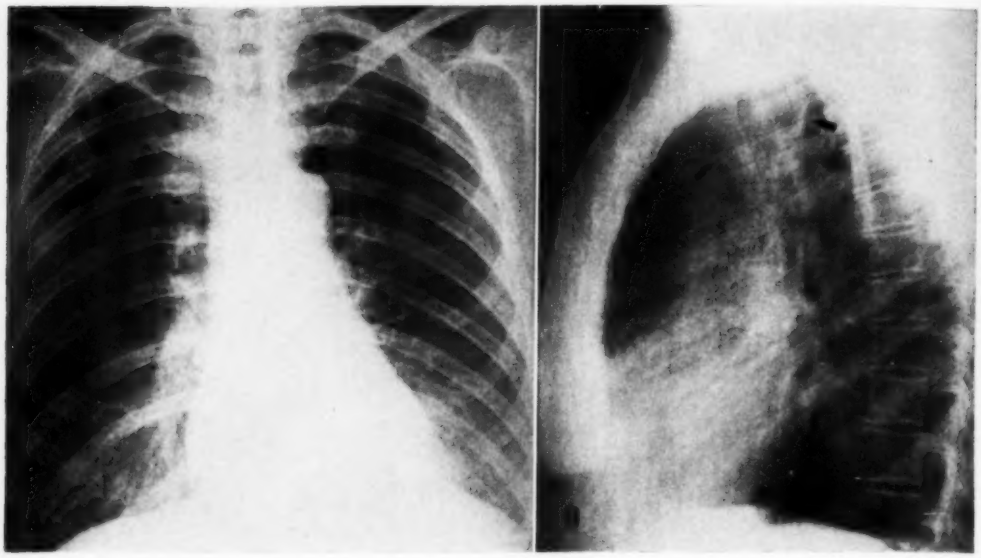


Fig. 11. The apical (B_1) segment of the right upper lobe.
E. T., a 55-year-old housewife, complained of chest pain and a cough, productive of blood-tinged sputum, for one week.
A. Postero-anterior view. Faint haziness just lateral to the right superior mediastinum.
B. Lateral view. The density is triangular in shape and extends to the apex of the lung (arrows).
This represents a pneumonic process in the apical (B_1) segment of the right upper lobe. Again the importance of the lateral view to locate the disease and to demonstrate the segmental character is evident.

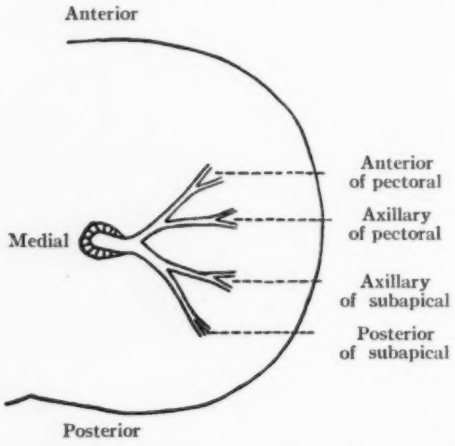


Fig. 12 (adapted from Brock). This is a diagram of the pectoral (B_2) and the subapical (B_3) bronchi of either upper lobe (in this case shown as the right) as seen from above. The axillary subdivisions of these bronchi (B_{2a} and B_{3b}) run laterally toward the axilla. These subsegmental bronchi have separate points of origin. The arteries closely parallel the bronchial subdivisions, so that the vessels also have orifices at some distance from each other. It can thus be seen that when *both* axillary subsegments are the site of disease and the adjacent subsegments are normal, it is almost impossible for the etiology to be a *single* bronchial occlusion (neoplasm) or a *single* vascular occlusion (infarct). Any such occlusion, large enough to cause changes in *both* subsegments, would also cause changes in the other subdivisions of the pectoral and subapical segments.

Thus the possible etiology of lesions in this area is narrowed down to fewer causes, and a clearer understanding of pathogenesis of such disease processes is obtained. The most common cause of involvement of these segments, as a unit, is pneumonia.

should impart a greater sense of urgency, since lesions in these segments are more likely to prove to be malignant.

In our experience, carcinoma arising in the middle lobe bronchus is quite rare. Brock has pointed out that the middle lobe bronchus is vulnerable to the effect of lymph node enlargement because it lies in the lymphatic pathway from the right lower lobe and is closely surrounded by numerous lymph nodes which drain the middle and lower lobes. In confirmation of this, Graham, Burford, and Mayer (8) have reported 12 cases and Paulson and Shaw (15) have described 32 cases of collapse of the middle lobe due to inflammatory disease. In the discussion of Paulson and Shaw's paper it was evident that many

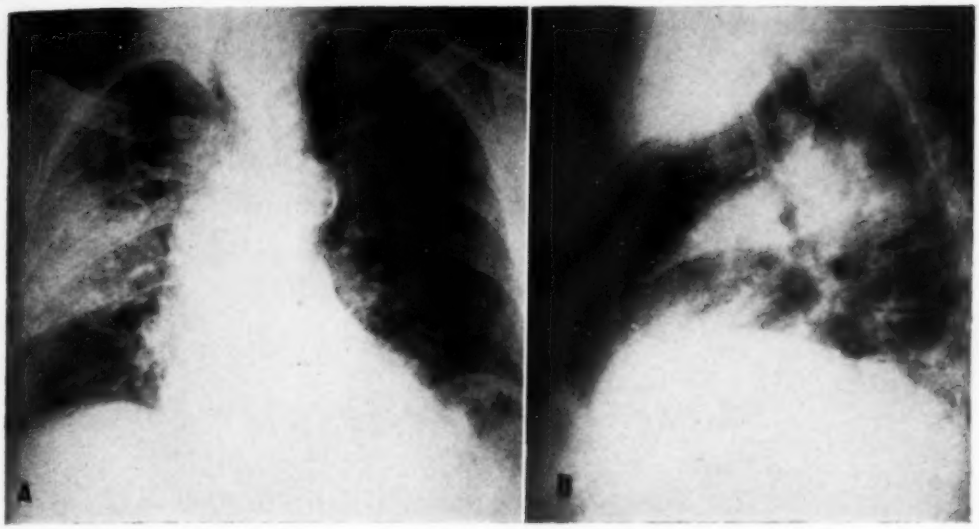


Fig. 13. The axillary subdivisions of the subapical (B_3) and the pectoral (B_2) segments of the right upper lobe.
M. E., an elderly white female, was admitted with a fairly typical story of lobar pneumonia.
A. Postero-anterior view. Homogeneous density in the right mid-lung field, limited sharply below by a normally placed minor septum.
B. Lateral view. Infiltration is in the axillary line but seems to be divided into two adjacent parts, with the posterior one having a greater vertical diameter. This shadow does not correspond to the distribution of any one bronchopulmonary segment, but rather to a combination of the axillary subdivision (B_{2a}) of the pectoral and axillary subdivision (B_{3b}) of the subapical segment.
Even without the fairly typical clinical history, this distribution should indicate that the primary process is not bronchogenic tumor or pulmonary infarct, because of the involvement of two subsegments which do not have common or adjacent orifices. See Fig. 12 for line drawing of bronchial anatomy of this area. This is an important point in pathogenesis and differential diagnosis of lesions in this location.

other observers had seen similar cases. We also have had a number of patients, who fall into this group (12). Thus, collapse of the middle lobe *alone* is much more likely to be the result of inflammatory disease than of neoplasm.

Accurate localization of the diseased bronchi or bronchopulmonary segments is of importance in treatment, not only when the surgical approach is being discussed, but also when postural drainage is to be prescribed. Obviously the position of a lesion in the lung and the direction pursued by the bronchi draining that area are significant considerations when the proper position for this procedure is decided. This has been mentioned by Foster-Carter and Hoyle and by Nelson (14).

Conceptions of the *pathogenesis* of various pulmonary diseases have undergone considerable change as the result of a better understanding of the anatomy of the bronchopulmonary segments. It was once believed that pneumonia began near the hilum and spread peripherally. We now know that pneumonia is a peripheral disease from the beginning and that it is frequently localized, at first, in a segment or parts of several segments. The concept of a "central" pneumonia is not correct. Figures 14 and 19 show shadows which appear to be "central" in location on the postero-anterior film but which can be identified as segmental in the lateral view. The pneumonic process may spread by involvement of adjacent segments, but not in a diffuse fashion, centrifugally from the hilum.

A knowledge of the anatomy of the axillary subsegments of the pectoral (B_{2a}) and the subapical (B_{3b}) segments of the upper lobes is of great help in clarification of the pathogenesis of lesions in these

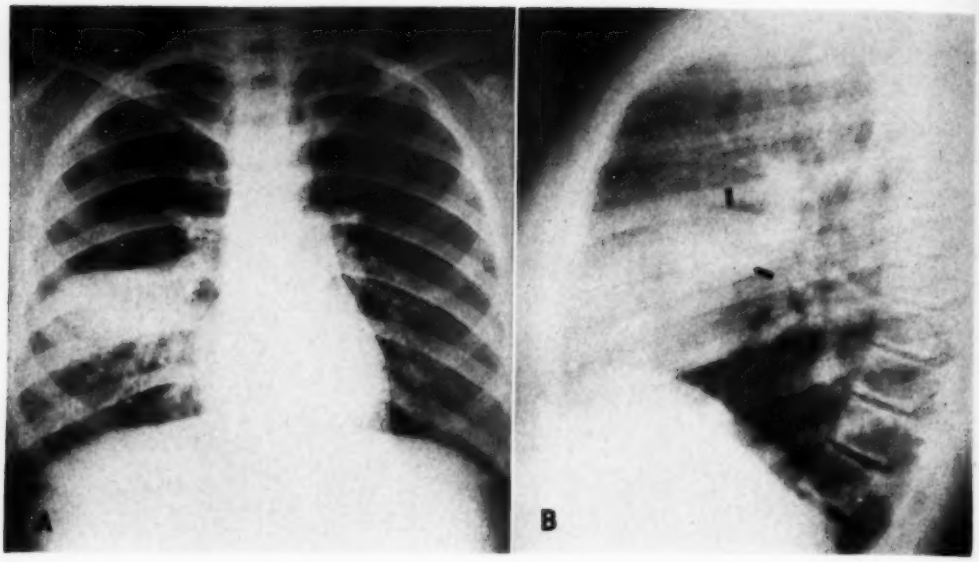


Fig. 14. The lateral (B_4) segment of the middle lobe.

B. L., a 13-year-old white girl, was admitted with symptoms of pneumonia.

A. Postero-anterior view. Homogeneous dense shadow sharply limited by the minor interlobar septum above, fading out gradually at its lower border.

B. Lateral view. The density is confined to the posterior part of the middle lobe and is limited not only by the minor septum above, but by the long septum behind (arrows).

This is the characteristic location of the lateral segment of the middle lobe (Fig. 2). In this instance the density is due to pneumonia.

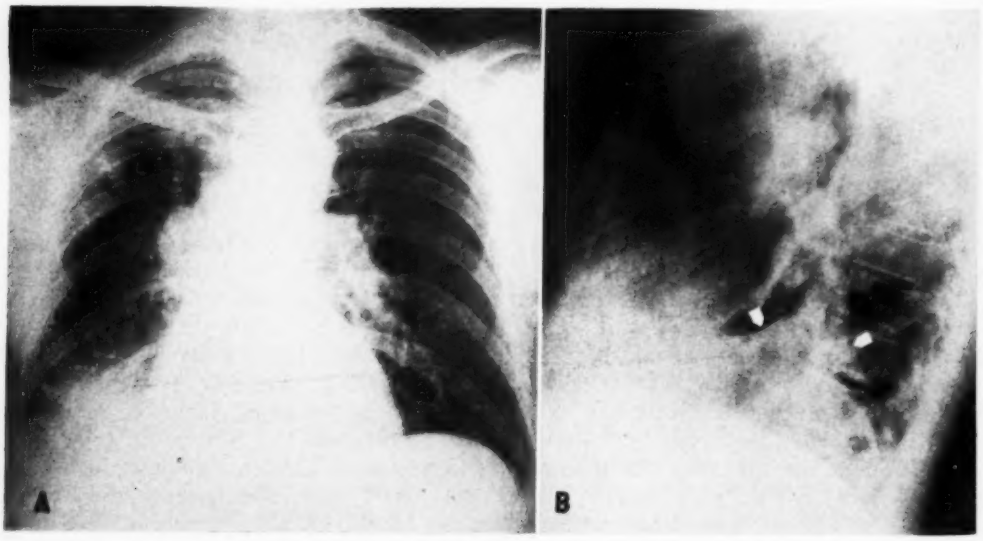


Fig. 15. The basal segments (B_7 to B_{10}) of the right lower lobe.

C. F., a 60-year-old white male, had received x-ray therapy elsewhere for a mass in the right hilum. The mass had disappeared but had recurred two months later.

A. Postero-anterior view. The mass in the right hilum has recurred and there is an irregular hazy shadow in the lower third of the right lung.

B. Lateral view. The shadow between the arrows represents partial collapse of all the basal segments. Just above the posterior arrow there is complementary emphysema of the apical segment of the lower lobe.

This case illustrates collapse of the basal segments of the right lower lobe with complementary emphysema of the apical segment. The diagnosis was made on the basis of the lateral roentgenogram; the point of obstruction, just below the orifice of the apical bronchus, was confirmed by bronchoscopy.

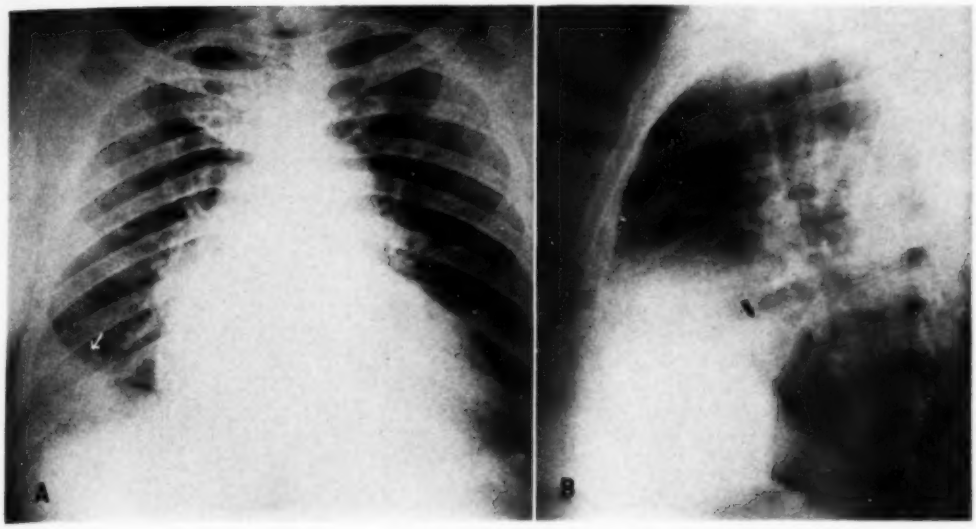


Fig. 16. The anterior basal (B_8) segment of the right lower lobe.

R. T., a 54-year-old colored male, complained of pain in the chest, dyspnea, cough, and blood-streaked sputum for two days.

A. Postero-anterior view. A homogeneous shadow is seen just above the right leaf of the diaphragm (arrow), laterally. The appearance suggests a small pleural effusion, but the density is "humped" medially and does not rise higher laterally.

B. Lateral projection. The density is behind the long septum and in contact with it (arrows). This is the anterior basal segment (B_8).

The lateral view demonstrates that the shadow seen in the postero-anterior roentgenogram is not due to pleural effusion. The use of exact terminology to describe the location and extent of the shadow is superior to the term "hump shadow" in the right costophrenic angle. In this case the parenchymal shadow is due to an infarct.

areas (see Fig. 12). Brock has emphasized that these secondary sublobar branches arise from different branches and thus do not have a common orifice. Any bronchial occlusion large enough to obstruct *both* axillary subbranches, therefore, will also obstruct the remaining branches of the pectoral and subapical bronchi, and the resultant collapse will be greater than the volume accounted for by the axillary subsegments.

Since the vascular supply closely parallels the bronchial distribution, the possibility of an infarct involving only the combination of the axillary subsegments is quite remote. In this instance, also, any thrombus large enough to occlude the separate orifices of the respective arteries will occlude other branches as well. The most common cause of abnormal density in this area is pneumonia (Figs. 8 and 13).

In the past, bronchogenic carcinoma has been considered to be predominantly a disease of the primary or of the lobar bronchi. Carcinomas arising in the sublobar bronchi were regarded as rare. Most cases were diagnosed on the basis of large areas of collapse which could be explained only on the basis of obstruction of a large bronchus. Such lesions were usually within range of bronchoscopic vision and biopsy. During recent years, more peripheral lesions have been proved, so that at many institutions, including our own, the *percentage* of positive bronchoscopic biopsies prior to surgery has declined. These carcinomas which arise in sublobar bronchi have been recognized and correctly treated because small peripheral shadows have been identified as areas of segmental collapse and the occlusion of the branch bronchus has been demonstrated by bronchography. As further data are accumulated, including experience gained in mass chest surveys, it will become increasingly

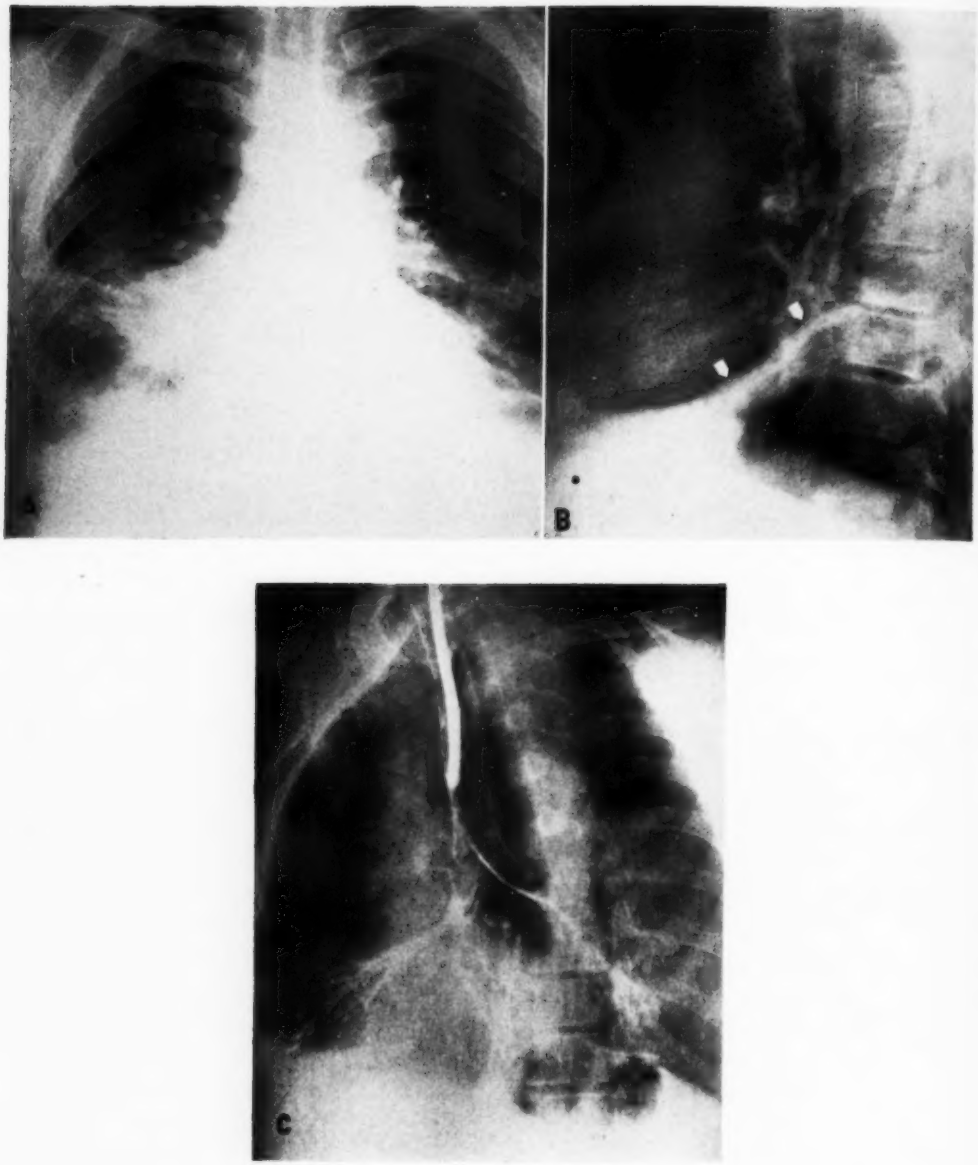


Fig. 17. The anterior basal (B_8) segment of the right lower lobe.

N. C., a 58-year-old white male, had a productive cough for six weeks.

A. Postero-anterior view. Hazy shadow in the lower portion of the right lung field, lacking distinct borders.

B. Lateral view. The shadow is located precisely just behind the long septum and sharply demarcated by it (arrows).

C. Bronchogram. The left anterior oblique view reveals only two major basal branches, with no filling of the anterior basal branch (B_8) to the area of collapse. The middle lobe bronchi are depressed. The presence of neoplasm was confirmed at surgery.

Note the fact that the lateral view clearly demonstrates the segmental character of the disease and that the bronchogram demonstrates the bronchial occlusion. The bronchogram was done without delay because of the duration of the symptoms and the anterior position of the shadow.

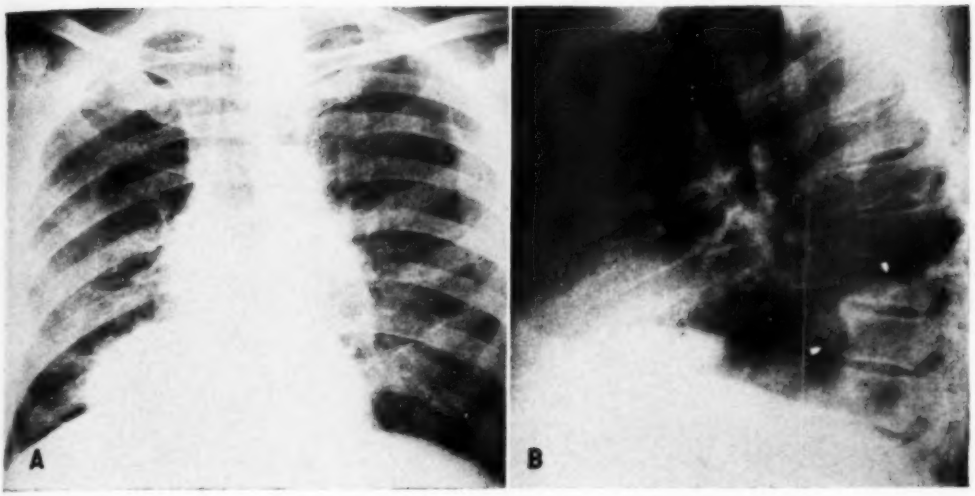


Fig. 18. The posterior basal (B_{10}) segment of the left lower lobe.

H. L., a 62-year-old white male, complained of a "cold" three months prior to admission and of a persistent cough, productive of a dark brown sputum.

A. Postero-anterior view. Round, dense shadow at the *medial* portion of the right base.

B. Lateral view. The shadow is in the posterior basal segment (arrows) and its shape suggests a peripheral tumor mass. Carcinoma was proved.

The characteristic medial location of this segment in the postero-anterior projection should be noted, although the lateral view is required to identify the segment with certainty.

apparent that more bronchogenic carcinomas arise in sublobar bronchi than has been considered to be the case. A number of carcinomas shown in this report were diagnosed on the basis of collapse of a group of segments, a single segment, or a subsegment (see Figs. 3, 4, 7, 17, 22). Other cases presented similar findings initially but progressed to complete lobar collapse as the result of extension of the tumor toward the hilum (Fig. 9). If such a case were seen for the first time when the whole lobe was collapsed, the impression would certainly be gained that the tumor arose in the lobar bronchus.

With closer scrutiny of peripheral lesions, the use of radiographs in multiple projections, judicious use of bronchography, and an appreciation of the segmental anatomy, a greater proportion of primary bronchogenic neoplasms will be found to originate in sublobar bronchi. Incidentally, the earlier diagnosis of such lesions should yield a higher proportion of operable and curable cases.

SELECTION OF CASES

The radiographs reproduced have been chosen to illustrate involvement of a group of segments, a single segment, or a portion of a segment by different disease processes. These include neoplasm, pneumonia, infarct, and postoperative atelectasis. The cases are grouped by lobes, and an attempt has been made to be as complete as our material allowed in demonstration of the various segments.

Study of these reproductions and comparison with the diagrams in Figure 2 will yield the best appreciation of the roentgen appearance of the bronchopulmonary segments affected by disease.

CONCLUSIONS

1. A good working knowledge of the anatomy of the sublobar bronchi and bronchopulmonary segments is of great importance, since a precise description and accurate localization of an abnormal shadow will influence considerations of

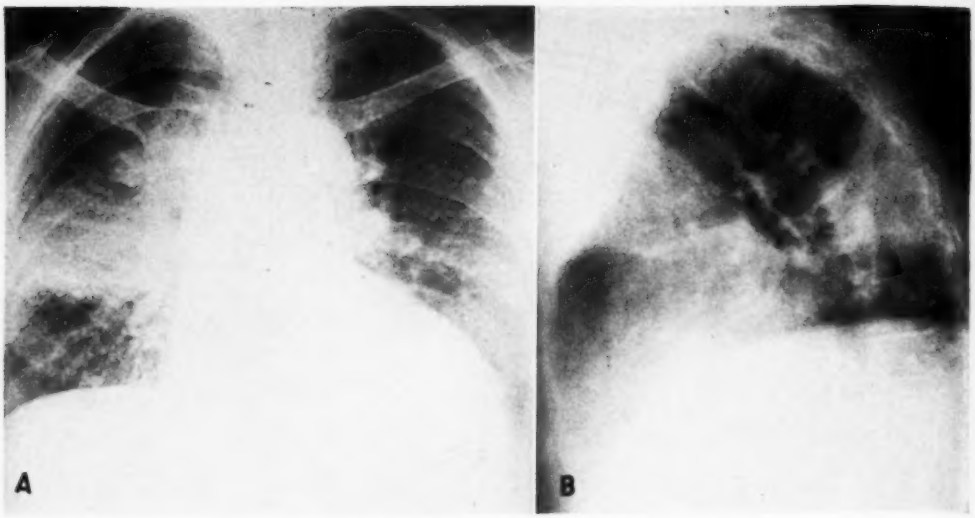


Fig. 19. The apical (B_6) segment of the right lower lobe.

K. R., a 75-year-old female, was admitted in diabetic acidosis. The following day she expectorated some bloody sputum.

A. Postero-anterior view. Homogeneous shadow of increased density in the right mid-lung field.

B. Lateral view. The shadow is in the apical (B_6) segment of the lower lobe and its triangular shape (arrows) is clearly demonstrated. Segment is of normal size.

Again in this instance, the lateral view is critical in the determination of the location and, to some extent, the final diagnosis of pneumonia.

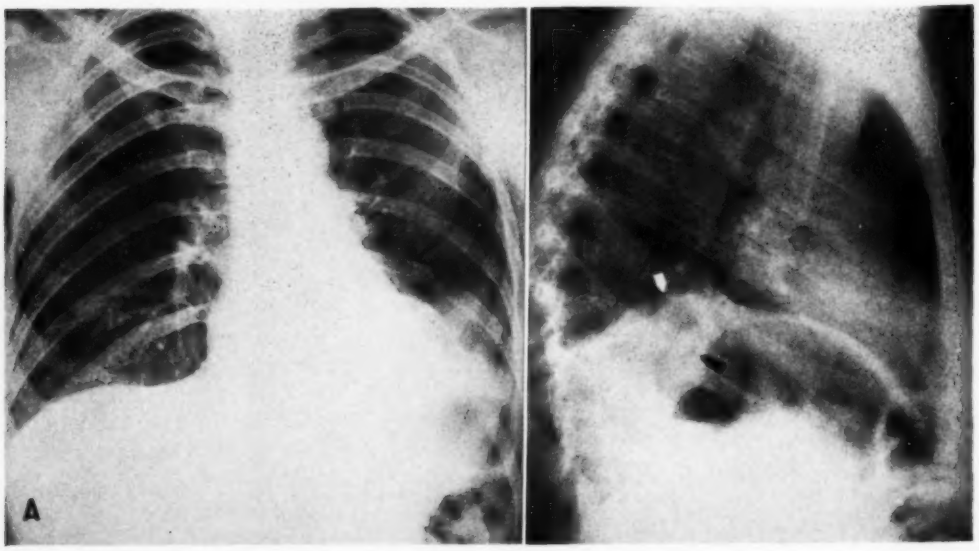


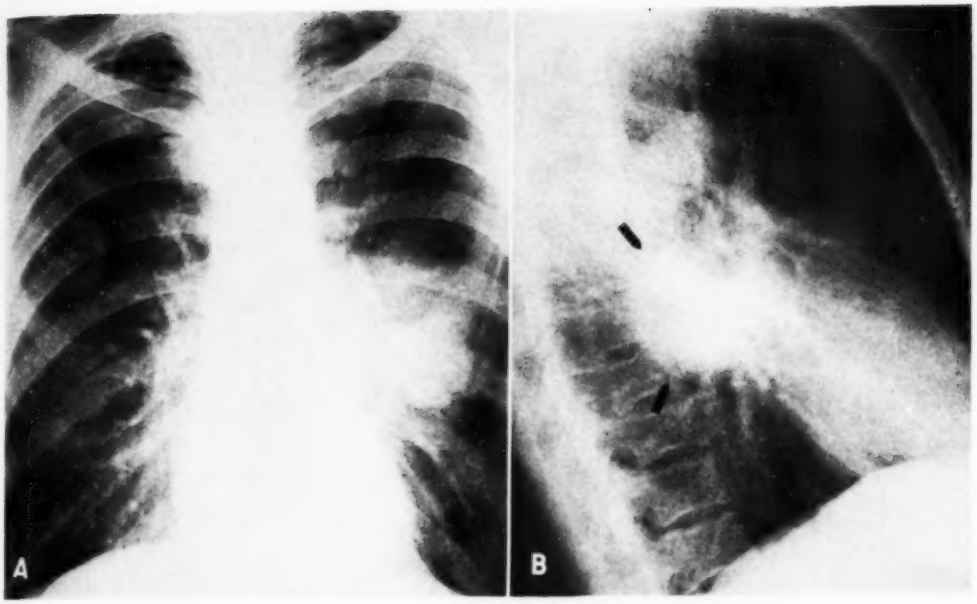
Fig. 20. The posterior basal (B_{10}) segment of the right lower lobe.

G. J., a 36-year-old white housewife, had a non-productive cough and fever, occurring twelve days after transplantation of both ureters.

A. Postero-anterior view. Slight elevation of the left leaf of the diaphragm, with haziness immediately adjacent to the cardiac border.

B. Lateral view. The shadow is triangular (arrows) and just behind the dome of the diaphragm.

This is a case of postoperative atelectasis of the posterior basal (B_{10}) segment which cleared within twenty-four hours. The characteristic postero-inferior position of this segment, its diminution in size when collapsed, and the complementary emphysema of the adjacent apical (B_6) segment are clearly demonstrated.



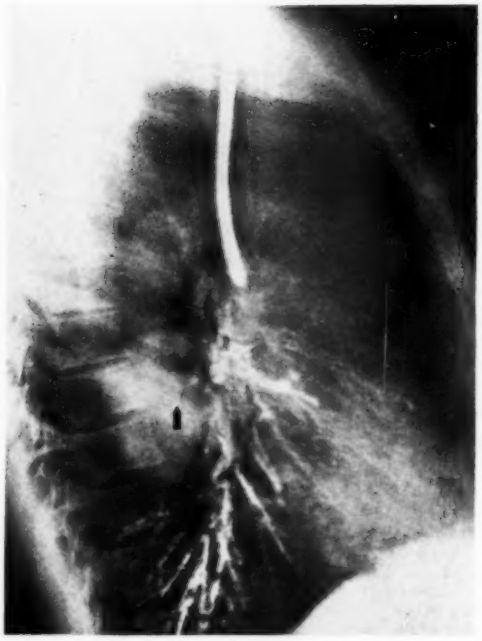
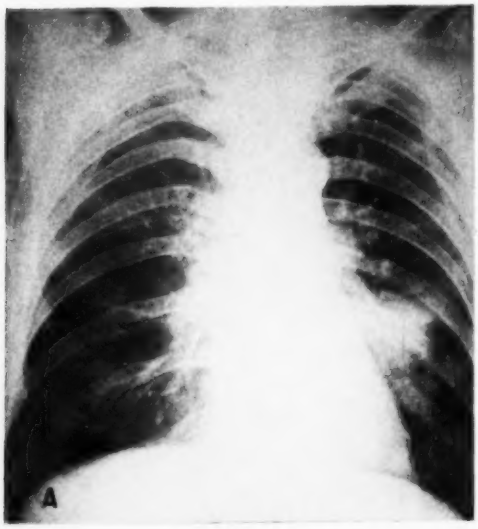


Fig. 21. The apical (B_6) segment of the left lower lobe.
S H., a 52-year-old white male, complained of a chronic cough for eight months following a "virus pneumonia."
A. Postero-anterior view. Rounded dense shadow in the left mid lung.
B. Lateral view. The shadow is posterior in position and in the apical segment (arrows).
C. Bronchogram. The apical bronchus is occluded (arrow). Tumor in the apical segment was confirmed.
The lateral view clearly demonstrates the location of the involved segment and the bronchogram shows occlusion of that bronchus.



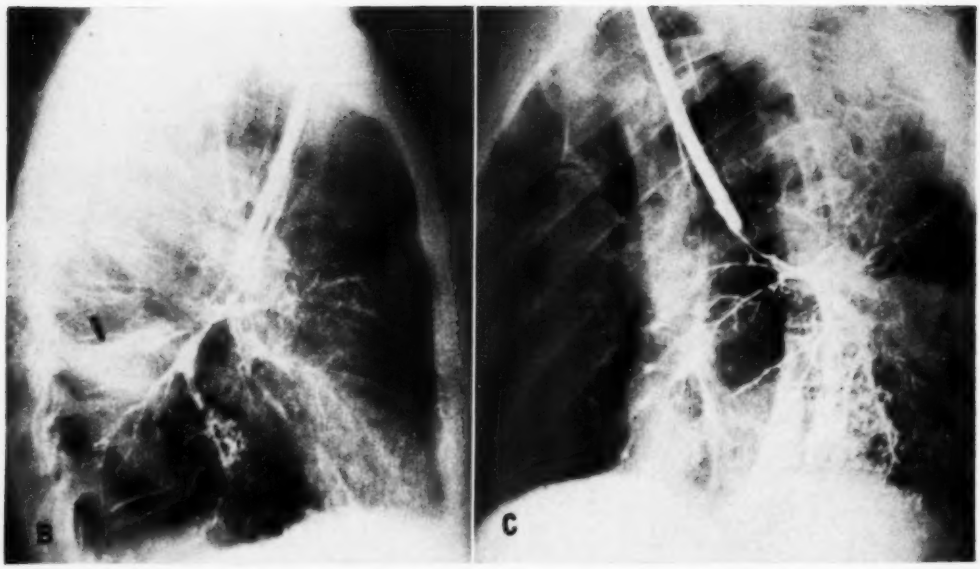


Fig. 22. The paravertebral (B_{6c}) subdivision of the apical segment of the left lower lobe.
G. P., a 67-year-old white male, had a short history of hemoptysis, cough, and weight loss.
A. Postero-anterior view. Poorly demarcated, paracardiac shadow of increased density. In the lateral view (not shown) this is in the apical segment of the lower lobe.
B and C. Bronchograms. Lateral and right anterior oblique positions reveal that the paravertebral branch (B_{6c}) of the apical bronchus is occluded (arrows). This was due to bronchogenic carcinoma.
This case illustrates that even subdivisions of segments can be identified on bronchograms and that the block of a small subsegmental bronchus can be identified.

differential diagnosis, pathogenesis, and therapy.

2. A single postero-anterior roentgenogram of the chest is entirely inadequate for this purpose. Lateral views are essential; oblique projections and bronchograms are of great help.

3. Diminution in size of a segment in-

dicates collapse. The presence or absence of bronchial occlusion must then be determined.

4. Once the segmental character of a disease process has been recognized, every effort should be made to establish an accurate etiologic diagnosis.

5. The presence of a shadow of unknown etiology in an anterior segment should impart a sense of special urgency because here the possibility of neoplastic disease is somewhat greater.

6. Bronchogenic carcinoma frequently arises in a sublobar bronchus. In such cases, the diagnosis may be made before the lesion is visible bronchoscopically.

7. It is most unusual for a disease process which involves *only the combination* of the axillary subdivisions of the pectoral and subapical segments of the upper lobe to be due to bronchial or vascular occlusion.

NOTE: Appreciation is expressed to Drs. Leo Asher and Albert Bennett for the drawings and to Mr. Robert Newhouse for the photographic reproductions.

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SUMARIO

La Anatomía de los Segmentos Broncopulmonares: Aplicaciones Clínicas

Un buen conocimiento práctico de la anatomía de los bronquios sublobulares y de los segmentos broncopulmonares reviste mucha importancia, dado que la descripción precisa y localización exacta de una imagen anormal afectará puntos enlazados con el diagnóstico diferencial, la patogenía y la terapéutica. Para este

propósito resulta absolutamente inadecuada una sola radiografía postero-anterior del tórax. Las vistas laterales son indispensables; las proyecciones oblicuas y las broncografías aportan considerafile ayuda.

La disminución del tamaño de un segmento indica colapso, y entonces hay que determinar la presencia o ausencia de oclusión bronquial.

Una vez reconocida la naturaleza segmentaria de un proceso patológico, hay que hacer todo lo posible para establecer el diagnóstico etiológico exacto. La presencia de una sombra de etiología desconocida en un segmento anterior debe infundir una sensación de urgencia extremada, por ser algo mayor allí la posibilidad de afección neoplásica. El carcinoma broncógeno tiene su origen frecuentemente en un bronquio sublobular. En esos casos, puede hacerse el diagnóstico antes de que la lesión sea visible broncoscópicamente.

Es sumamente extraño que se deba a oclusión bronquial o vascular un proceso patológico que sólo afecte la combinación de las subdivisiones axilares de los segmentos pectoral y subapical del lóbulo superior.

Laminagraphy in the Diagnosis of Nasopharyngeal Tumors[1]

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THE CLINICAL diagnosis of nasopharyngeal tumors usually is delayed until the appearance of symptoms referable to the eyes, ears, or upper nasal passages. As a result of their insidious onset, radiologic recognition of such growths is even further delayed, as indicated by the emphasis placed on the demonstration of bony changes in the base of the skull.

It is generally agreed that most nasopharyngeal tumors, exclusive of those arising as primary or metastatic growths in the subjacent bone, originate in the soft tissues of the nasopharynx (1). While the radiologic identification of soft-tissue changes is occasionally mentioned as an important sign of such tumors, further efforts to portray these more clearly are required. Such attempts may occasionally lead to a correct diagnosis before invasion of bone has occurred, thereby increasing the possibility of cure by appropriate radiotherapy. The present communication is concerned with the application of laminagraphy to the diagnosis of nasopharyngeal tumors.

REVIEW OF LITERATURE

Jönsson (8) stressed the visualization of areas of erosion in the base of the skull in his series of 33 tumors of the nasopharynx. He also advocated lateral roentgenograms with the tongue protruded as far as possible, to aid in the demonstration of the soft parts of the growth. Cutler and Buschke (4) recommended soft-tissue studies of the nasopharynx after the introduction of a contrast medium, such as lipiodol, intranasally with the head in a downward position. Lenz (9) stated it as his belief that lateral skull films do not demonstrate nasopharyngeal tumors, and regarded verticomental views as essential. In 40 cases so examined he observed osseous changes in the base of the skull in 19.

Belanger and Dyke (3) emphasized the importance of stereoroentgenograms of the base of the skull, stating that without these a diagnosis of nasopharyngeal cancer could seldom be made radiologically. They mentioned principally destruction of the sphenoid body, the basiocciput, and the medial margin of the great wing of the sphenoid. Proliferative changes were seen by them on two occasions. Lateral studies were, in their opinion, of little help, inasmuch as in only 2 cases out of 14 could a mass be definitely seen. They reproduce a lateral midline laminagram, however, portraying a soft-tissue mass in the nasopharynx (their Figure 8).

MacComb and Martin (10) asserted that roentgenograms taken in the position usually employed for outlining the paranasal sinuses would reveal the extent of bony destruction. Whiteleather (14) found that lateral and mentovertex views of the nasopharynx and oropharynx often showed luminal defects in the posterior and lateral walls. Thickening of the posterior pharyngeal walls was noted even when the luminal defects were small. Graham and Meyer (7) stated that lateral views of the skull were useful in demonstrating a soft-tissue mass in the nasopharynx, but considered the basal views more contributory. Van Metre (13) also recommended basal views, finding erosions in the base in 12 out of 21 patients. Soft-tissue tumor shadows displacing the nasopharyngeal air column were seen by him in 7 cases, a rather small incidence in view of the fact that in all of his 46 patients there was clinical evidence of a growth. Simmons and Ariel (12) also favored stereoscopic views of the base of the skull.

[1] From the Radiologic Service of M. G. Wasch, M.D., The Jewish Hospital of Brooklyn, Brooklyn, N. Y. Aided by the Celia Antonoff Memorial Fund. Accepted for publication in July 1950.

PRESENT OBSERVATIONS

There were 10 patients in the series to be reported here, of whom 6 were women. The youngest was a fourteen-year old boy with a nasopharyngeal angiofibroma and the oldest a sixty-seven-year-old woman with a huge lymphoepithelioma. Six patients were between fifty and sixty years of age, and 3 were between twenty-five and thirty-five years. Biopsy specimens revealed 5 lymphoepitheliomas, 2 lymphoblastomas, 1 squamous-cell carcinoma, and 1 angiofibroma. In the remaining patient four successive biopsies were reported as inconclusive, even though nasopharyngoscopic examinations repeatedly disclosed a tumor.

The presenting symptoms in the 9 adults were diplopia in 5; nasal discharge, bleeding, and obstruction to breathing in 5; poor hearing in 2; headache in 2, and palpable lymph nodes in the neck in 3. In 4 cases the tumor was identified on the patient's first admission, while in the other 6 there was a delay of from two weeks to three months, during which time treatment had been given for a variety of conditions, including sinusitis, nasal polyps, and respiratory infections. The boy with the nasopharyngeal angiofibroma presented himself after about eight months because of slowly progressive swelling producing the so-called "frog-face."

The radiologic investigations included lateral and basal stereoroentgenograms of the skull, and postero-anterior and antero-posterior views. In addition, a midline lateral laminagram was obtained in each case. Inspection of the routine lateral stereoroentgenograms showed an abnormal soft-tissue shadow protruding into the nasopharynx in 3 instances. In 5 a suspicious soft-tissue shadow could be identified in retrospect, having been undiagnosed previously. In the remaining 2, no abnormal soft-tissue prominences were noted even on a review of the films.

Destruction of the sella turcica of an advanced degree was present in one patient with lymphoepithelioma; in another, with lymphoblastoma, the dorsum sellae showed a small area of erosion. In the remaining 8 there were no visible changes in the contours of the sella turcica or the sphenoid bone demonstrable on the lateral stereoroentgenograms. Decalcification of the greater wings of the sphenoid could be seen in the frontal projections through the orbits in 3 cases, while in the remaining 7 no changes were noted. The paranasal sinuses were normal in 8; in 2 a diffuse cloudiness was observed over the maxillary and ethmoidal sinuses.

Stereoscopic roentgenograms of the base of the skull showed no visible changes in 3 patients. In the patient with advanced sellar destruction, the entire base of the skull had vanished; the remaining 6 showed varying degrees of erosion involving the ipsilateral petrous tip, the greater wing of the sphenoid, the sphenoid body, and the basiocciput. In 3 this change was readily detected, but in the other 3 there was ample room for difference of opinion.

Laminagraphy lends itself particularly well to the radiologic investigation of the nasopharynx. By this technic the nasopharyngeal soft tissues may be demonstrated sharply by elimination of overlying bony shadows. A heavier radiographic technic brings out the bony confines of the nasopharynx. In a previous publication (6) application of laminagraphy to the radiologic examination of the sphenoid bone was discussed and its effectiveness in visualizing the anterior and inferior walls of the body of the sphenoid was mentioned. No reference, however, to the portrayal of nasopharyngeal soft tissues was made at that time.

To obtain a midline laminagram, the head should be positioned as for a routine lateral skull roentgenogram. Inasmuch as we employ a five-second exposure with an apparatus utilizing spiral motion (the Keleket-Kieffer laminagraph), immobilization of the head is required. The plane for examination is selected by measuring the height of the glabella from the table top. A proper midline laminagram should show the sphenoidal plane, the sella turcica, the basiocciput, and the odontoid process

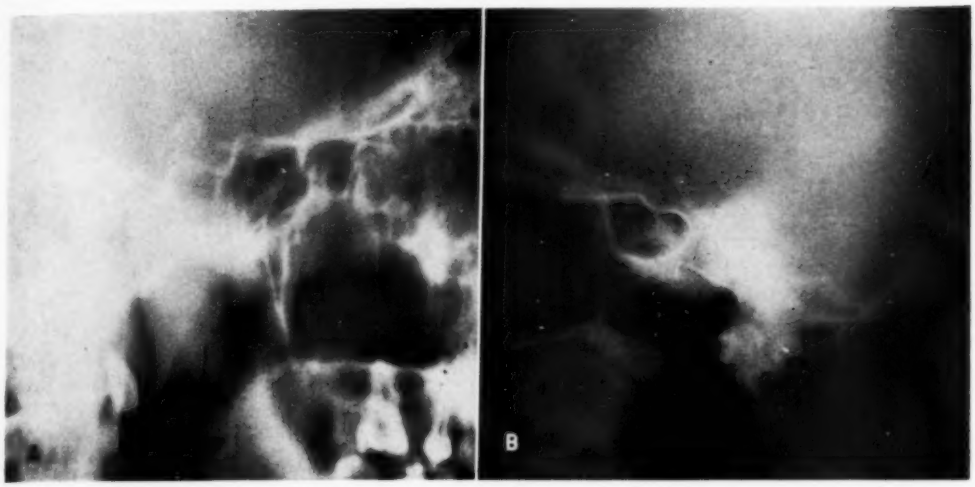


Fig. 1. Normal midline laminagrams. A. Soft-tissue technic. B. Heavier technic for bone.

sharply. The anterior and inferior walls of the sphenoid bone may be readily recognized. The anterior wall may be broken by the opening of the sinus, but the inferior wall is usually intact and is continuous with the basiocciput.

In normal adults, and in younger people without adenoid hyperplasia, the soft tissues of the nasopharynx closely follow the bony contours. As a rule, the thickness of these soft tissues rarely exceeds 1.5 cm. and their curve follows the declivity of the inferior wall of the sphenoid and the basiocciput. At a level beginning beneath the midportion of the floor of the sphenoid and extending to just beneath the odontoid process, the soft tissues are thicker and may present a gentle but definite anterior bulge. Lower in the pharynx, immediately anterior to the upper and middle cervical vertebrae, they are not as thick as opposite the first and second cervical vertebrae.

Anteriorly the hard palate may be seen in continuity with the soft palate and the uvula. Lower down the oral pharynx is bounded anteriorly by the back of the tongue and dorsally by the thin constrictor pharyngeal muscles. Adenoid hyperplasia may usually be identified by its smooth, almost semicircular borders, convex downward, just beneath the antero-inferior aspect of the sphenoid. The vomer is rarely visualized except on the sharpest and most accurate of lateral laminagrams but may be seen on coronal laminagrams.

The lateral laminagrams of the patients with nasopharyngeal tumors were of particular interest in that they enabled us to identify definitely soft-tissue tumefaction in the nasopharynx in each case. Soft-tissue thickening in the vicinity of the antero-inferior aspect of the sphenoid and basiocciput was demonstrable, varying from a coarsely irregular nodular prominence high in the nasopharynx to a smooth soft-tissue mass occupying a major portion of the nasopharynx and extending down to the oral pharynx. In some cases this was sufficiently large to push the uvula and soft palate downward. In the 2 patients in whom soft-tissue changes in the nasopharynx could not be identified on the lateral stereoroentgenograms even in retrospect, the tumor was quite evident on the laminagrams. In the other 8 patients the laminagrams showed the soft-tissue masses to far better advantage than the stereoroentgenograms.

In 2 cases, sclerotic changes could be seen involving the antero-inferior aspect of the sphenoid and the basiocciput. These were not demonstrable either on the routine lateral or basilar stereoroentgenograms. One of these patients had a squamous-cell

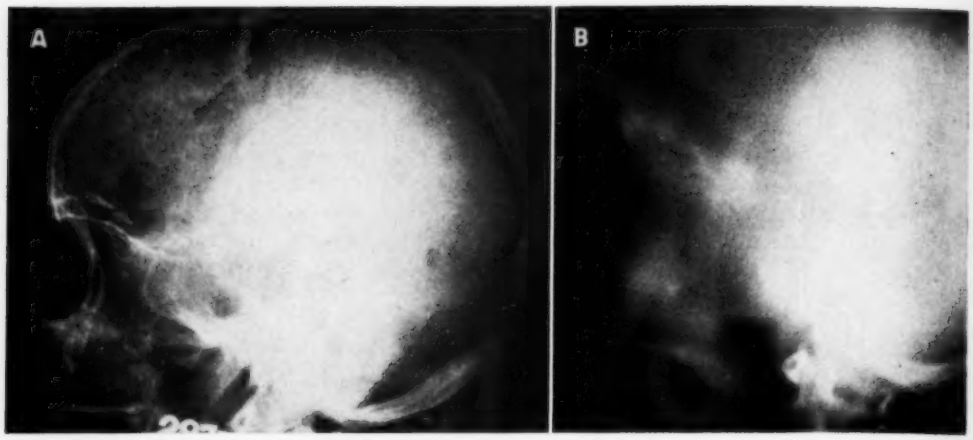


Fig. 2. Case 1. A. Lateral roentgenogram of the skull showing destruction of the sphenoid bone and the sella turcica. The nasopharyngeal soft-tissue markings are obscured by the overlying jaws. Some decalcification of the sphenoidal plane is present.
B. Lateral midline laminagram. The extensive destruction of the entire sphenoid bone and invasion of the nasopharynx, ethmoid sinuses, and nasal cavity are clearly visible.

carcinoma, the other a lymphoblastoma.

Destructive changes in the body of the sphenoid were demonstrated laminagraphically in 2 patients. For this purpose, however, the base stereoroentgenograms were found superior to laminagrams, particularly when the destruction was lateral to the midline.

The patient with the nasopharyngeal angiofibroma presented but little change on the routine roentgenograms. On the lateral midline laminagram, however, the nasopharyngeal soft-tissue component of the tumor was seen to fill the entire nasopharynx. The routine postero-anterior view showed an opacity with a smooth border convex upward over the ethmoid sinuses. This mass was seen in its entirety on the postero-anterior laminagram, and its extension into the nasal chamber causing deviation and erosion of the vomer and the nasal septum was evident.

ILLUSTRATIVE CASE REPORTS

CASE 1: S. K., a 66-year-old woman, was admitted because of pain in the left side of the hard palate and protrusion of the left eye. Painful swelling of the eye had first appeared one year before admission, when the patient had a stroke. The protrusion became progressively worse and was accompanied by diplopia and finally blindness.

Physical examination disclosed left exophthalmos, a diminished left corneal reflex, pallor of the left optic disk, and blindness and limitation of external movement of the left eye. There was no adenopathy, nor was there paresis of the facial muscles. Hearing on the left side was impaired. Examination of the nasopharynx disclosed a neoplasm extending from the left side of the roof of the nasopharynx into the left postchoanal space, occluding the breathing space on that side. Tissue removed at biopsy proved to be lymphoepithelioma.

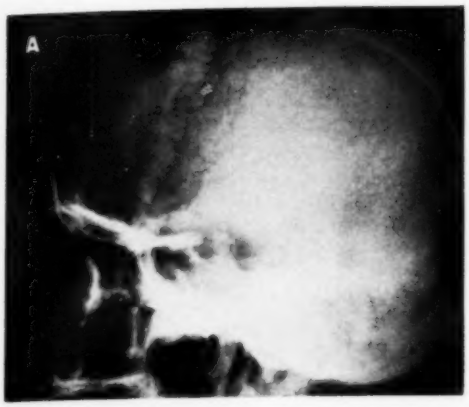
Right lateral stereoroentgenograms of the skull revealed marked destruction of the sphenoid bone, including the sella turcica. Basal stereoroentgenograms showed decalcification of the petrous tips and the greater wings of the sphenoid.

Midline laminagrams revealed the extensive destruction of the sphenoid in a more graphic and complete fashion than the routine studies. The sphenoidal plane had vanished and the basiocciput had also been completely destroyed. A large soft-tissue mass protruded far into the nasopharynx and oral pharynx.

The patient received several courses of deep x-ray therapy cross-firing the sphenoid region. Some symptomatic improvement followed, but the proptosis did not recede nor did vision return. About two years after the onset of the illness a left subtemporal decompression was performed, and a large growth filling the anterior and middle cranial fossae was found. This was entirely extradural and had eroded the bony structures beyond recognition. Tissue removed for biopsy again showed lymphoepithelioma.

Death occurred five years after the disease had been recognized.

CASE 2: H. K., a 51-year-old man, first noticed double vision six months before admission. He com-



optic disks was present. There were bilateral paralysis of the external rectus muscles and analgesia over all three divisions of the left trigeminal nerve. The left corneal reflex was absent. A motor paralysis of the fifth nerve on the left side was found, and there was conduction deafness on the left. The palate deviated to the right on phonation. The left palatal and gag reflexes were absent. The tongue deviated to the left on protrusion.

Examination of the nasopharynx revealed a smooth neoplasm occupying the roof and lateral wall on the left side, surrounding the eustachian tube. Tissue removed for biopsy was reported as epidermoid carcinoma.

Right lateral stereoroentgenograms of the skull were normal. The frontal and basal projections were likewise not remarkable. A midline lamina-

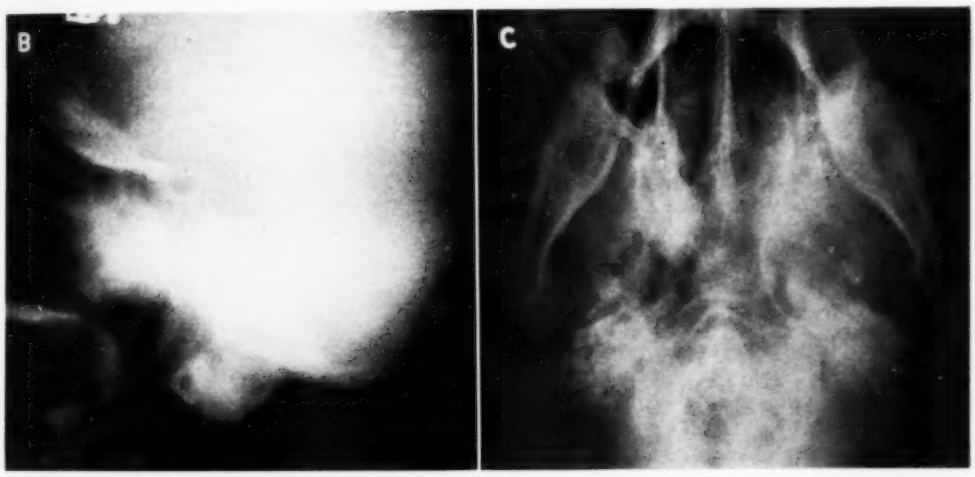


Fig. 3. Case 2. A. Lateral roentgenogram of the skull. The nasopharynx is normal, and the sella turcica intact.

B. Lateral midline laminagram showing sclerosis of the antero-inferior aspect of the sphenoid bone not visible on the routine lateral roentgenogram.

C. Basilar roentgenogram, showing no destruction of bone. The sclerotic changes seen on the laminagram cannot be demonstrated in this view.

plained of a sensation as if the corner of his left eye were pulling inward. About the same time he lost his sense of smell. This was followed by a sensation of numbness and pain on the left side of the face. There was a bloody discharge from the nose. About four months before admission, the left ear felt as if it were plugged, and hearing diminished. About three months later his left eye began to blink involuntarily and finally closed. The tongue felt numb for about a month, and there was some difficulty in swallowing. Hoarseness was present for one month. There was a weight loss of 70 pounds in seven months.

Physical examination showed ptosis of the left eye. The left pupil was smaller than the right, and both reacted to light and accommodation. Pallor of both

gram, however, disclosed a large, rather dense tumor high in the nasopharynx, well above the uvula. Considerable sclerosis of the anterior and inferior walls of the sphenoid body and the basiocciput was present. The mass protruded anteriorly to approximately the level of the posterior part of the hard palate. The sphenoidal plane was intact.

The patient received several courses of deep x-ray therapy. He died three and one-half years after admission.

CASE 3: B. L., a 56-year-old man, first experienced pain in the back of his head six months prior to admission. Later this spread to his ear, eye, and throat on the right side. There was also difficulty in breathing through the nose.

nodular soft-tissue prominence was seen in the nasopharynx just inferior to the sphenoid.

Examination of the nasopharynx then revealed a flat tumor in the nasopharynx. A biopsy done at that time was reported as showing acute and chronic inflammatory tissue, but a second biopsy one week later disclosed squamous-cell carcinoma.

The patient received deep x-ray therapy, and reexamination of the nasopharynx two months later showed a large ulcerated cavity in the right side of the nasopharynx where the original mass had been located. He did not return for further treatment.

CASE 4: L. H., a 14-year-old boy, first experienced difficulty in breathing through his nose six months before admission. Swelling of the left side of the face began four months before he was admitted and had increased progressively so that a marked prominence was evident, closing his left eye to a considerable degree. No adenopathy or other positive physical findings were observed. At operation, a large mass high in the nasopharynx, extending into the nasal chamber, was partially removed. X-ray

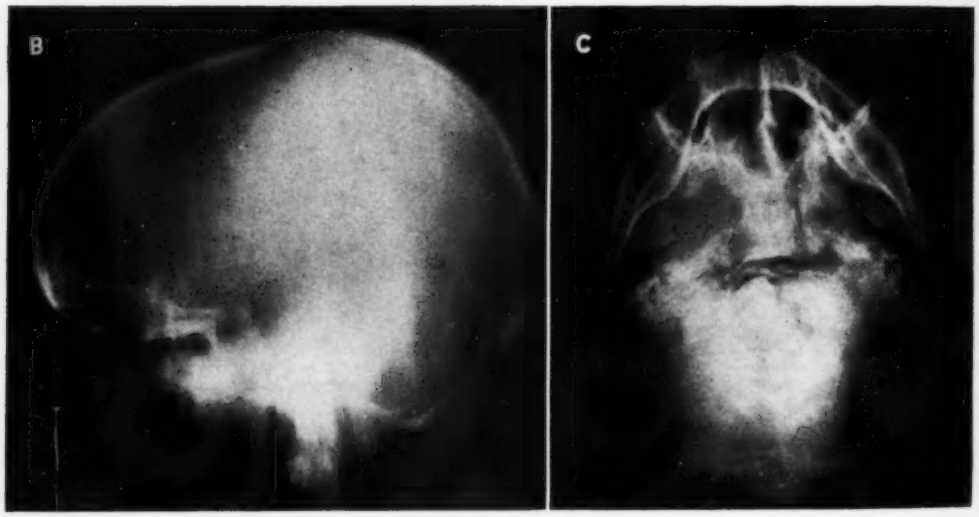


Fig. 4. Case 3. A. Lateral roentgenogram centering on the nasopharynx. No pathologic changes are visible.
B. Lateral midline laminagram, revealing sclerotic changes in the antero-inferior aspect of the sphenoid.
C. Basilar view showing destruction in the region of the right lacerated foramen.

Nasal polyps were seen on examination, together with a deviated septum. No lymph node enlargement was present. X-ray examination of the nasal sinuses disclosed a right pansinusitis, but treatment for sinusitis and nasal polyps gave no relief. Reexamination of skull revealed no changes on the routine stereoroentgenograms in the lateral and frontal views, but the base stereoroentgenograms showed a definite excavation in the region of the left lacerated foramen. A midline laminagram revealed sclerosis of the anterior and inferior walls of the body of the sphenoid extending to the basiocciput. A rather therapy was started thereafter. The tissue was reported as angiofibroma.

COMMENT

In the radiologic approach to the diagnosis of nasopharyngeal tumors, their origin in the soft tissues must be kept in mind. It would appear logical, then, to increase our efforts for the demonstration of abnormal soft-tissue shadows and, when these are found, to insist that they be

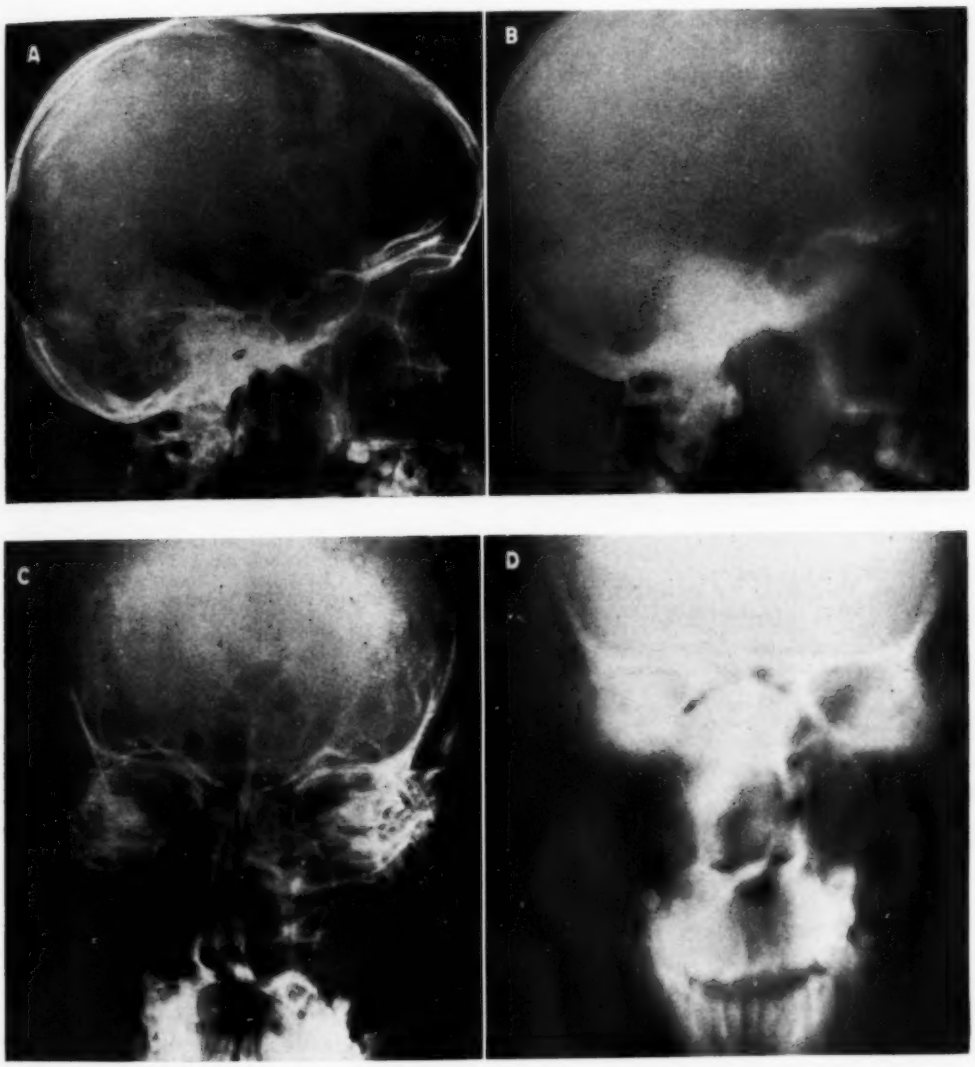


Fig. 5. Case 4. A. Lateral roentgenogram of the skull, showing no visible skeletal change. The nasopharynx does not appear remarkable.

B. Lateral midline laminagram, revealing a large soft-tissue mass filling the nasopharynx, displacing the uvula downward. The posterior wall of the antrum is thinned, and the antero-inferior aspect of the sphenoid body is decalcified. The basiocciput is somewhat thickened.

C. Postero-anterior view of skull. Overlying the ethmoid sinuses is a smooth curvilinear shadow convex upward.

D. Postero-anterior laminagram. The mass originating in the nasopharynx is sharply demarcated. The deviation of the vomer to the left is clearly delineated; extension of the mass toward the right antrum can be seen.

further investigated clinically. Jönsson's report of four cases diagnosed radiologically before the appearance of clinical signs may well serve as a guide to what we hope to accomplish.

With the frequent use of radiologic examination of the nasal sinuses in patients with symptoms referable to the upper respiratory tract, a great opportunity for the detection of soft-tissue abnormalities in the nasopharynx exists. The lateral films should be carefully examined with

this in mind, and, as indicated by the present report, laminagraphy in the midline may be of great assistance in evaluating abnormal soft-tissue changes in this region. In the present series of cases, soft-tissue abnormalities could be visualized in each instance on the laminagrams; routine stereoroentgenograms showed a definite soft-tissue shadow in only 3 instances.

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SUMARIO

La Laminagrafía en el Diagnóstico de los Tumores Nasofaríngeos

La mayor parte de los tumores nasofaríngeos, aparte de los que surgen como neoplasias primarias o metástasis en el hueso subyacente, tienen su origen en los tejidos blandos de la nasofaringe. El frecuente examen radiológico de los senos paranasales en los enfermos con síntomas imputables a las vías aéreas superiores ofrece ocasión de distinguir sombras de los tejidos blandos, lo cual debe conducir a una investigación clínica más detenida.

Al A. la laminagrafía le ha resultado de valor para descubrir esas alteraciones de los tejidos blandos. En su serie de 10 casos, tomó estéreorradiografías laterales y basales del cráneo y vistas postero-anteriores y antero-posteriores. Además, obtuvo en cada caso un laminagrama lateral en la línea media. En 3 casos, las estéreorradiografías laterales revelaron en los tejidos blandos una sombra anormal que proyectaba en la nasofaringe, en tanto que en otros 4 se identificó retrospectivamente una sombra sospechosa en los tejidos blandos. En 2, no se observaron, ni aun al repasar las películas, prominencias anómalas de los tejidos blandos. En estos 2 casos, el tumor aparecía claramente en el laminagrama, mientras que en los otros 8, las tumefacciones eran reveladas mucho mejor por la laminagrafía que por la estéreorroentgenografía.

Horner's Syndrome: Roentgen Manifestations[1]

RAPHAEL POMERANZ, M.D., F.A.C.R.

Newark, N. J.

HARE (1) IN 1838 AND HORNER (2) in 1869 described the group of clinical symptoms now known as Horner's syndrome. It consists of miosis, ptosis of the upper lid, enophthalmos, dryness of the skin of the face, and vascular hyperemia. In progressive cases, paresthesia of the arm follows, succeeded in turn by muscular atrophy. All symptoms are ipsilateral.

This syndrome is produced by damage to the cervical sympathetic or to part, or all, of its ganglia at the eighth cervical or the first two thoracic levels, the severity of the manifestations depending on the extent of the lesion. The same symptoms may be the result of damage to the ciliospinal center of the spinal cord at the appropriate levels or to the roots extending from those parts of the cord. Causative lesions include neoplastic invasion of the nerve sheaths or walls of the arteries and secondary degenerative changes produced by pressure.

The etiologic factors in the development of Horner's syndrome and the clinical data may be summarized as follows:

HORNER'S SYNDROME: CLINICAL AND ETIOLOGIC FACTORS

I. *Symptoms* (all ipsilateral)
   1. Miosis, paralysis of the dilator pupillae
   2. Ptosis of the upper lid, paralysis of the tarsal muscle
   3. Enophthalmos, paralysis of the orbital muscle (Müller)
   4. Anhidrosis of the skin of the face
   5. Vascular hyperemia of the face
   6. Paresthesia of the arm followed by muscular atrophy (Klumpke syndrome)

II. *Pathology*
   1. Damage to the cervical sympathetic or part or all of its ganglia, at the level of C-8, D-1, and D-2
   2. Damage to the ciliospinal center of the spinal cord at the same level
   3. Damage to roots of above mentioned neurons and their communicating branches

III. *Causes* (producing pressure and degeneration or direct invasion and destruction of the neurons)*
   1. Congenital
      Status dysraphicus, cervical rib, congenital spine deformities (r.d.)
   2. Inflammatory:
      Herpes zoster (c.d.)
      Tuberculosis, osseous or glandular, level of C-8, D-1, and D-2 (r.d.)
      Syphilis: aneurysm (c.d. and r.d.)
      Epidemic meningitis (c.d.)
      Encephalitis (c.d.)
      Anterior poliomyelitis (c.d.)
   3. Traumatic
      Postoperative complications, pneumolysis, gun and knife wounds, thoracotomies, paravertebral block, phrenicotomy, hematomyelia; level of C-8, D-1, and D-2 (c.d. and r.d.)
   4. Degenerative
      Bulbar palsy, syringomyelia (c.d.), scleroderma (Bing, 3) (c.d.)
   5. Neoplastic
      Lymphosarcoma, Hodgkin's disease (c.d. and r.d.)
      Neurofibrosarcoma, epipharyngeal carcinoma (Bremer) (c.d. and r.d.)
      Thymoma, struma maligna (c.d. and r.d.)
      Bronchogenic carcinoma with soft-tissue metastases at level of C-8, D-1, D-2 (no bone destruction) (c.d. and r.d.)
      Pancoast tumor, with bone destruction (r.d. and c.d.)
      Metastases to soft tissues and bone from distant neoplasms (r.d. and c.d.)
      Tumor of the gasserian ganglion (c.d.)

* c.d., Clinical diagnosis. r.d., Radiologic diagnosis.

Of the congenital conditions which may produce Horner's syndrome special mention may be made of "status dysraphicus." This is a constitutional hereditary anomaly due to defective closure of the primary neural arch at the level of the lower cervical

[1] From the Department of Radiology, Newark City Hospital, Newark, N. J., Dr. P. J. Santora, Roentgenologist. Accepted for publication in August 1950.

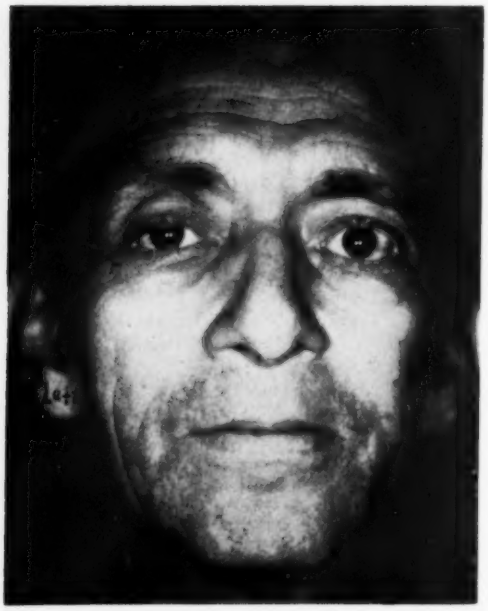

Fig. 1. Case 1. Note the dropped eyelid on the left side, Horner's syndrome.

and upper thoracic segments (Bremer; Passow). Bremer (4) proved histologically that the lesions consist of primary gliosis and cavity formations in the vicinity of the central canal of the spinal cord similar to those seen in syringomyelia. Passow (5) found clinically, in over 90 per cent of these patients, evidence of otherwise unexplainable Horner's syndrome. Other clinical symptoms are: *in males*, funnel chest, kyphoscoliosis, sternal anomalies, abnormal length of the upper extremities with increased extension span, trophic and vascular disturbances of the hand (acrocyanosis), flexion deformity of the little fingers; *in females*, heterochromia of the iris, breasts of unequal size with defective pigmentation of the mamillae, disturbances of sensibility. All symptoms are ipsilateral and are combined with Horner's syndrome in varying degrees of severity. Radiologically, one may find spina bifida at the level of C-8, D-1, and D-2. Neurologically, there may be additional symptoms of paresis of the sympathicus of the 5th, 6th, and 7th nerves.

Pancoast (6) in his paper on "superior pulmonary sulcus tumors," in 1932, included Horner's syndrome as an essential feature, indicating a lesion at the lower cervical or upper thoracic level with bone erosion. He suggested an origin from branchial rests for these tumors and regarded them as a clinical entity, though this latter view has been discarded by many subsequent writers.

Certainly not every case of Horner's syndrome is due to a Pancoast tumor. Examples of other origin have been reported by Morris and Harken (7), Stine and Draper (8), and DeJong (9), and others. In 1947, the present author had an opportunity to observe this syndrome in a number of patients, from a variety of causes. Five of his cases are reported below.

The object of these reports and the accompanying discussion is to make the radiologist Horner syndrome-conscious. Any patient presenting the syndrome should be studied roentgenologically for evidence of bone abnormalities, bone destruction, or soft-tissue masses in the lower neck or apical area. Horner's syndrome is a localizing sign. The radiologist and clinician should be aware of its implications and should co-operate for the sake of an early anatomic diagnosis.

CASE REPORTS

CASE 1: A white male, 52 years of age, was admitted to the hospital in August 1947, with a diagnosis of coronary disease and possible rheumatic heart disease, for which condition he had been treated over a period of several months in another hospital. The chief symptoms were weakness, palpitation, and anorexia. The patient complained also of a dull aching pain radiating from the left shoulder down to the left arm and fingers, with sharp exacerbations. Physical examination showed mild dyspnea and a loud blowing systolic murmur over the mitral area. The rhythm was irregular. The liver was enlarged, and there was ankle edema. A hard immovable mass was felt in the left lower posterior neck region, and a definite Horner syndrome was observed on the left side (Fig. 1). The blood pressure was 110/70. Laboratory studies of the urine and blood were normal. Electrocardiographic studies disclosed old myocardial damage.

X-ray examination on Aug. 5, 1947 (Fig. 2), revealed cardiac enlargement involving all chambers of

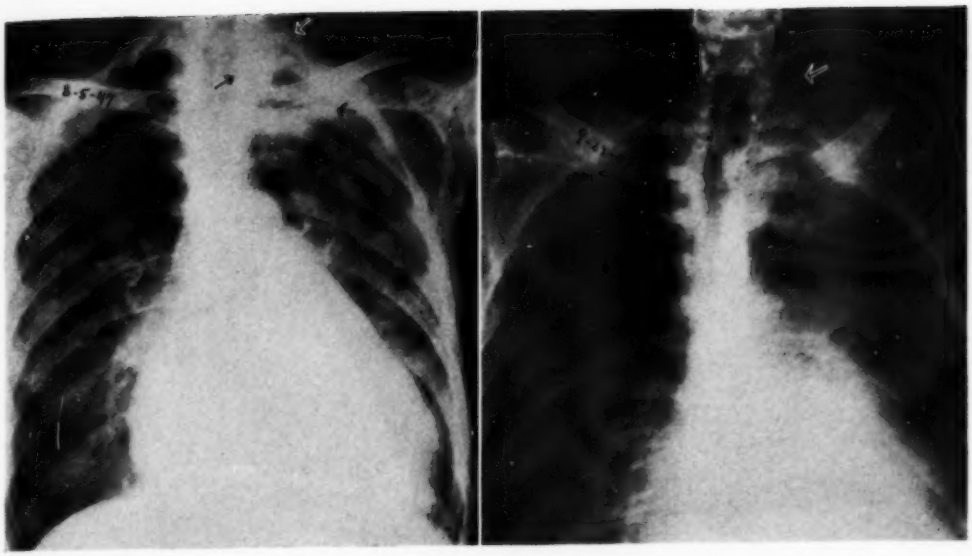

Fig. 2 (left). Case 1. Roentgenogram, Aug. 5, 1947, showing enlarged rheumatic heart, pulmonary congestion, and soft-tissue mass in left apex.
Fig. 3 (right). Case 1. Roentgenogram, Sept. 23, 1947. Note definite erosion of the left upper ribs. The soft-tissue mass has increased in size and density (Bucky film).

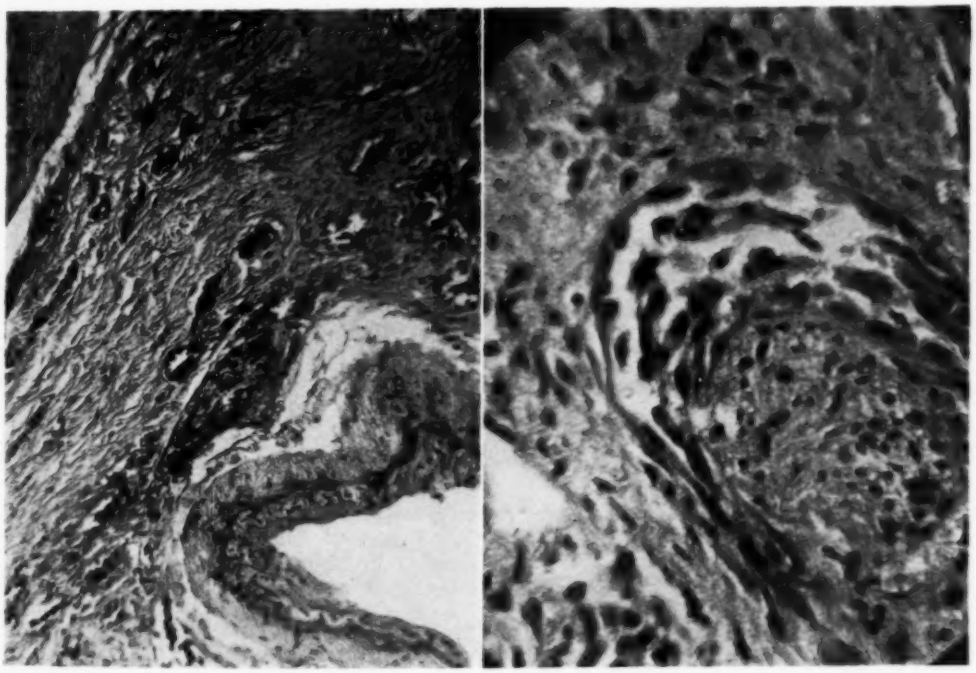

Fig. 4 (left). Case 1. Photomicrograph showing tumor cells invading the periarterial structures.
Fig. 5 (right). Case 1. Photomicrograph showing tumor cells invading the nerve sheaths.

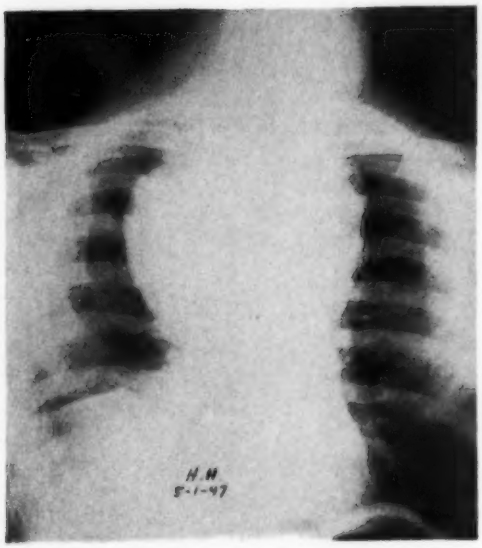

Fig. 6. Case 2. Roentgenogram showing large mediastinal mass, elevation of the right diaphragm, soft-tissue mass in the right neck. No bone destruction is seen.

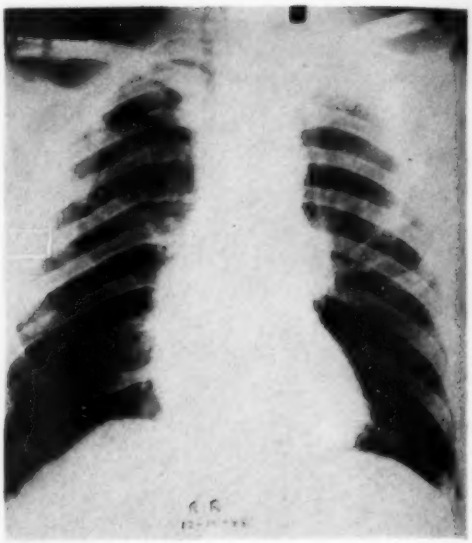

Fig. 8. Case 3. Roentgenogram showing glandular mass in the left hilus and soft-tissue mass in the left neck displacing the trachea to the right. No bone erosion was evident.

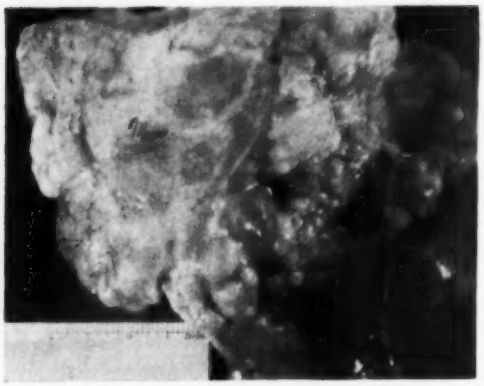

Fig. 7. Case 2. Specimen consisting of large mediastinal mass composed of anaplastic tumor tissue secondary to primary bronchial tumor.

the heart. The pulmonary arch was straight and there was evidence of pulmonary congestion. A soft-tissue density was observed in the region of the left apex. Subsequent studies, Sept. 23, 1947 (Fig. 3), showed definite erosion of the first and second ribs posteriorly on the left side and increased density of the soft-tissue mass.

Necropsy findings included chronic mitral valvulitis, probably rheumatic, with mitral insufficiency; dilatation and hypertrophy of the right ventricle and auricle and relative tricuspid insufficiency; myocardial failure; thrombosis of the right auricle, passive congestion of liver, spleen, and kidneys, and pulmonary edema; arteriosclerotic occlusion of the left coronary artery and healed infarct of the left ventricle. There was atrophy of the left upper extremity. A mass was found in the left upper lobe area attached to the first and second ribs and posterior cervical roots. On section, there was evidence of the tumor infiltrating the brachial plexus and the subclavian artery and its cervical branch extending to the thyroid. The lungs showed lymphangitic carcinoma spread for a short distance within the superior portion of the left upper lobe. Microscopically, the tumor consisted of epidermoid carcinomatous cells of plexiform type infiltrating the nerve branches and the arterial walls (Figs. 4 and 5).

CASE 2: A white male, 58 years of age, complained of difficulty in swallowing and shortness of breath for two weeks. He had been in good health until a swelling appeared in the right supraclavicular area, first noticed two months earlier. The mass grew rapidly. The patient's face was flushed. The veins over the anterior aspect of the thoracic cage were distended. A definite Horner's syndrome was found on the right side. A hard immovable mass was palpable in the right supraclavicular region.

X-ray studies (Fig. 6), including posterior, anterior, and lateral views, showed a large mediastinal mass obscuring the outline of the base of the heart and of the large vessels and displacing the trachea and esophagus; the right diaphragm was elevated due to damage of the phrenic nerve. A soft tissue mass was present in the right upper cervical region; there was no erosion of the ribs. The biopsy report

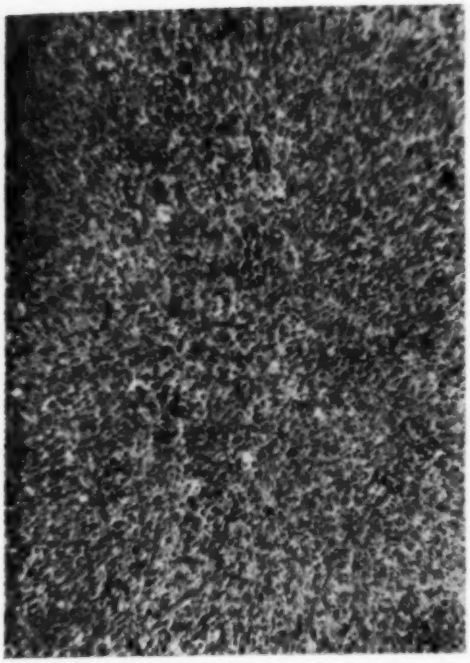

Fig. 9. Case 3. Photomicrograph of biopsy specimen, reported as Hodgkin's disease.

on the tumor in the neck was thymoma, lymphosarcoma, or possibly carcinoma.

Autopsy revealed a primary bronchial oat-cell carcinoma with marked anaplasia and metastatic extension into the mediastinum. The mass involved the large vessels and was adherent to the right superior fossa. There was no bone destruction or invasion (Fig. 7).

CASE 3: A white male, 45 years of age, complained of a mass in the left neck developing within four months prior to admission. He had pain in the left upper chest, paresthesias in the left hand, and muscular atrophy of the left arm. Clinical examination showed a definite Horner's syndrome on the left side.

X-ray examination (Fig. 8) revealed a glandular mass in the left hilus and a soft-tissue mass in the left neck. No bone erosion was evident. Biopsy disclosed Hodgkin's disease (Fig. 9). The patient responded well to radiation therapy but died within the year with signs of generalized lymphadenopathy. No autopsy was obtained.

CASE 4: A white male, 58 years old, complained of severe pain in the left upper extremity developing five months prior to admission, with edema and numbness of the left arm. He had lost 30 pounds in weight and within the last month had experienced a dry non-productive cough. Clinical examination showed a definite Horner's syndrome on the left side. A

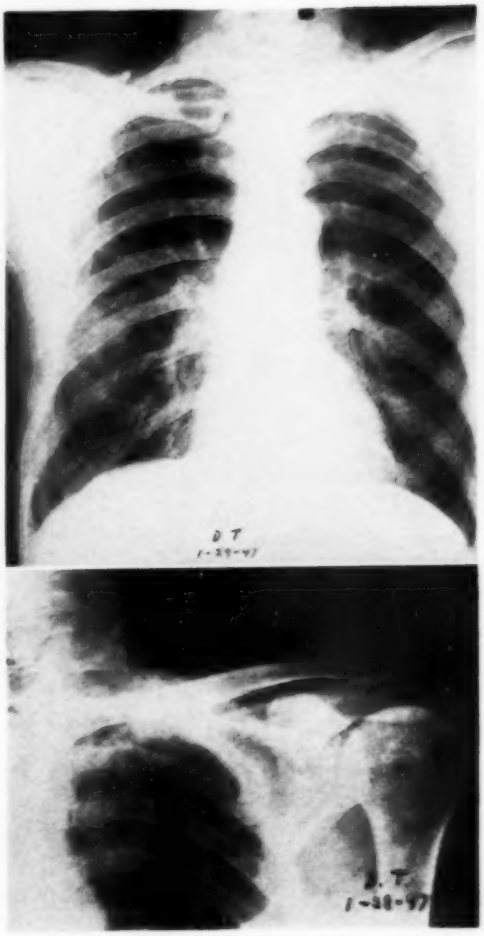

Fig. 10. Case 4. Roentgenograms showing obscuration of the left apex, erosion of the first rib, and a soft-tissue mass not sharply defined.

hard fixed mass was palpable in the left supraclavicular fossa. Neurologic examination revealed additional root involvement of the sixth cervical segment and of the ulnar nerve. The left arm was atrophied.

X-ray examination (Fig. 10) revealed a soft-tissue mass in the left supraclavicular region with destruction of the first rib and of the adjacent portions of the seventh cervical and first thoracic vertebrae. The left apex was obscured.

At *autopsy* a Pancoast tumor was found in the left supraclavicular fossa, with bony metastases from the level of the fifth cervical to the second thoracic vertebra. Pulmonary metastases were present in the right lower and left upper lobes. There was pulmonary edema. Microscopically, the tumor consisted of dense fibrous tissue and invasion of squamous-type carcinoma cells (Fig. 11).

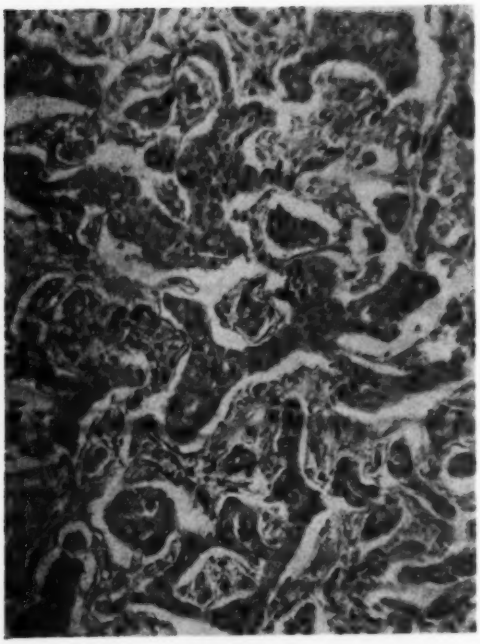

Fig. 11. Case 4. Photomicrograph showing dense fibrous tissue invaded by tumor cells of squamous type.

CASE 5: A white male, 48 years of age, had a productive cough and mucopurulent sputum, but no hemoptysis. Pain in the right shoulder had been present for several months. Examination showed consolidation of the right upper thorax. There was a supraclavicular mass on the right side and a definite Horner's syndrome. Biopsy of one of the cervical nodes showed metastatic cancer. X-ray studies (Fig. 12) disclosed a primary tumor of the right upper lobe, osteolytic bone lesions of the sixth and seventh cervical vertebrae, a soft-tissue mass on the right side of the neck, and an osteolytic lesion in the right humerus. This is an example of Horner's syndrome due to metastatic cancer, confirmed by autopsy.

COMMENT

The cases reported above illustrate various causes of Horner's syndrome proved by biopsy or autopsy. The alertness of the radiologist in correlating the clinical findings of Horner's syndrome with the x-ray findings will be of great help to the clinician, who may overlook the possibility of a deep-seated intrinsic lesion. On the other hand, the alert clinician will call to the attention of the radiologist the presence of a Horner's syndrome, with the hope that he

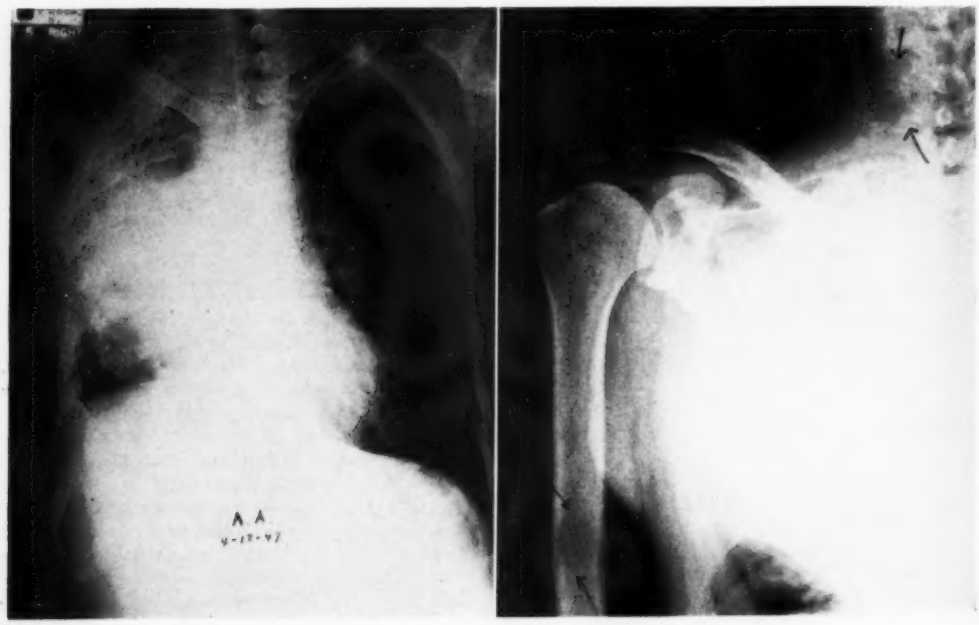

Fig. 12. Case 5. Primary cancer of the right upper lobe with osteolytic metastatic lesions of the sixth and seventh cervical vertebrae, right side, and of the humeral shaft, proved by autopsy.

may be able to establish the etiology. Unfortunately no figures are available as to the incidence of the causative factors listed earlier in this paper.

SUMMARY

Horner's syndrome is a localizing sign for the clinician and radiologist, indicating a lesion at the eighth cervical or first and second thoracic levels. By careful correlation of the clinical and radiologic findings the exact etiologic factor can be established. The causes are manifold, including soft-tissue masses, bone destruction, or both.

Five cases demonstrating as many different causes of this syndrome are presented.

NOTE: I am indebted to Drs. P. Gianquinto and H. Bernhard for Case 2, to Dr. O. G. Caprio for assistance in preparation of the material, and to Dr. H. S. Martland for the use of autopsy records.

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SUMARIO

El Síndrome de Horner: Manifestaciones Roentgenológicas

El síndrome de Horner es un signo localizador que indica una lesión a la altura del octavo segmento cervical o primero o segundo dorsal. Reconoce una gran variedad de causas, incluso invasión neoplásica de las vainas nerviosas o paredes de las arterias o alteraciones degenerativas secundarias debidas a la compresión. Todo enfermo que acuse este síndrome debe ser estudiado a fondo roentgenológicamente en busca de signos de anomalías óseas, osteólisis, o masas de tejido blando en la porción inferior del cuello o zona dorsal superior.

El radiólogo y el clínico deben darse cuenta por igual de las connotaciones del síndrome de Horner. La prontitud del radiólogo en correlacionar los hallazgos clínicos con el cuadro roentgenológico resultará de mucha ayuda al clínico, que puede desapercibir la posibilidad de una lesión intrínseca profunda. Por otro lado, el clínico avisado llamará la atención del radiólogo sobre la presencia de un síndrome de Horner, con la esperanza de poder así establecer la etiología.

Preséntanse 5 casos que demuestran causas distintas de dicho síndrome.

Mesenteric Lipoma: Report of a Case with Distinctive Roentgenographic Features[1]

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PRIMARY TUMORS originating in the mesentery are relatively uncommon but have received considerable attention in the surgical literature. They have been divided into two main groups, cystic and solid. Of these, the former are more prevalent according to most authors, although Rankin and Major (14) have reported a series of 22 cases of mesenteric tumors from the files of the Mayo Clinic with solid tumors outnumbering the cystic form 15 to 7.

There have been numerous discussions as to the exact definition of a mesenteric tumor. Some authors consider any neoplasm which extends into the mesenteric tissues, regardless of its point of origin, to represent a tumor of the mesentery; others limit the term to those primary growths which have their origin in the connective tissue between the leaves of any of the peritoneal folds, omenta, or mesenteries. Lipomatous tumors which fulfill the requirements of this more exact definition are rare, although lipomata are the most frequent benign solid type of mesenteric tumor, accounting for 33 per cent of the 15 solid tumors in the series of Rankin and Major and 27 per cent of the 56 cases reviewed by Harris and Herzog (7).

For more detailed discussion of the classification, as well as the etiologic theories, of mesenteric tumors, reference may be made to the articles by the above-mentioned authors and to the publications of Carter (4), Judd and McVay (8), and Phillips (13).

Mesenteric lipomata may reach large proportions before symptoms are produced. Bergouignan (2) reported one which weighed over 8 kilograms, and Lambrecht (10) described a case in which a tumor weighing 7.5 kilograms was removed. These fatty tumors are frequently multiple, and they show a marked tendency to local recurrence. Some authors (12) have observed that up to one-third of the cases of abdominal lipomata may show sarcomatous changes. The treatment is surgical removal whenever possible.

The symptoms of these fatty tumors are quite variable, depending upon their size and position, as well as upon the rapidity of growth. One patient was known to have had a large palpable mesenteric lipoma for eighteen years, but the usual history is much shorter. If the tumor is located close to the bowel, symptoms of obstruction may occur. The mass may be so situated as to produce urinary symptoms; and torsion of the bowel, with its resultant symptomatology, has also been noted. Often the chief complaint is a minor one, and some patients seek medical attention because of the discovery of a painless mass in the abdomen.

The physical findings in these cases likewise show considerable variation. A palpable abdominal mass with some degree of mobility, often to the right and below the umbilicus, should cause mesenteric tumor to be included in the differential diagnosis, although it is not the most common cause of such a mass. By further study one must rule out the more usual lesions such as intrinsic bowel tumors, tumors of the liver, pancreas, ovary, and kidney, as well as enlarged nodes due to Hodgkin's disease or leukemia. Thus the diagnosis of mesenteric tumor is largely one of exclusion.

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Several writers (1, 8, 14) have emphasized the mobility of the mesenteric tumors, and it has been noted that this often is greatest in the transverse direction. By physical examination it is even more difficult to distinguish between cystic and solid tumors in the mesentery, although Moynihan (11) felt that prominence of the fluctuating tumor toward the umbilicus, presence of a zone of resonance around the tumor, and a belt of resonance across the mass favored a diagnosis of cystic tumor. Lambrecht, in reporting his case of mesenteric lipoma, reflected that the gross loculation of the palpable mass should have pointed to the correct diagnosis of lipoma or, at least, some form of solid tumor.

Roentgen examination in cases of suspected mesenteric tumor finds its greatest value in the elimination of intrinsic tumors of the bowel, diseases of the gallbladder, and gross changes in the kidney. But this form of examination may also contribute in a positive way, as will be demonstrated by the case to be presented shortly.

The roentgen appearance of a mesenteric tumor might be expected to be the same regardless of the cystic or solid nature of the mass, unless the tumor contained material whose absorption of roentgen rays differed appreciably from that of the surrounding tissues. This requirement is met by those tumors which contain a high percentage of fatty tissue. Thus it might be expected that a lipoma of sufficient size would cast a roentgenographic shadow which would contrast with the shadows of the normal tissues containing a greater proportion of water. The reported cases of lipomata diagnosed by roentgen methods demonstrate that this expectation has been fulfilled.

Normal fat shadows are demonstrated in lateral roentgenograms of the knee and ankle in which the subpatellar and Achilles fat pads appear as clearly demarcated areas of decreased density. To Bufalini (3) generally is given the credit for first demonstrating a lipoma by this difference in roentgenographic density. He identified a lipoma in the soft tissues of the arm by the area of radiolucency with regular, clear-cut margins. Following his demonstration there have been numerous reports of lipomata with characteristic roentgenographic findings. Most of these reported fatty tumors have been in the soft tissues of the extremities (5, 9, 16, 17), but there have also been several reports of these same roentgenographic findings in cases of retroperitoneal lipomata. Windholz (18) recorded 3 cases in which he found translucent areas corresponding to the site of the retroperitoneal tumor and listed the roentgenographic findings that should suggest such tumors, namely, (*a*) displacement of the kidney without gross impairment of shape and function, (*b*) displacement of abdominal viscera without evidence of an organic lesion of the bowel wall, (*c*) expansive rather than infiltrative tumor growth, (*d*) no evidence of soft-tissue shadow of the tumor, (*e*) occasionally increased radiolucency of areas previously occupied by intestinal loops. Windholz also included a case of dermoid cyst which was somewhat translucent, and the relative radiotranslucency of this type of tumor has been noted by Samuel (16). Regan, Sanes, and MacCallum (15) reported 7 cases of retroperitoneal lipoma in which roentgenograms showed displacement of kidney and ureter in 2 cases and bowel displacement in another 2, but there was no mention of any difference in radiographic density due to the tumor mass. Likewise, the relative radiolucency of true mesenteric lipomata has not been mentioned in any of the cases herein reviewed (1, 6, 10, 14).

The technical factors involved in the visualization of fatty tissue in contrast to surrounding tissues of different density have been well explained by Templeton (17). He points out that the roentgen-ray absorption of fat is less than that of water; therefore, fat will absorb less radiation than the other soft tissues, which are composed largely of water. The differentiation between the roentgen-ray absorption of fat and that of water increases as the wave length of the radiation becomes longer or as the thickness of the tissue increases.

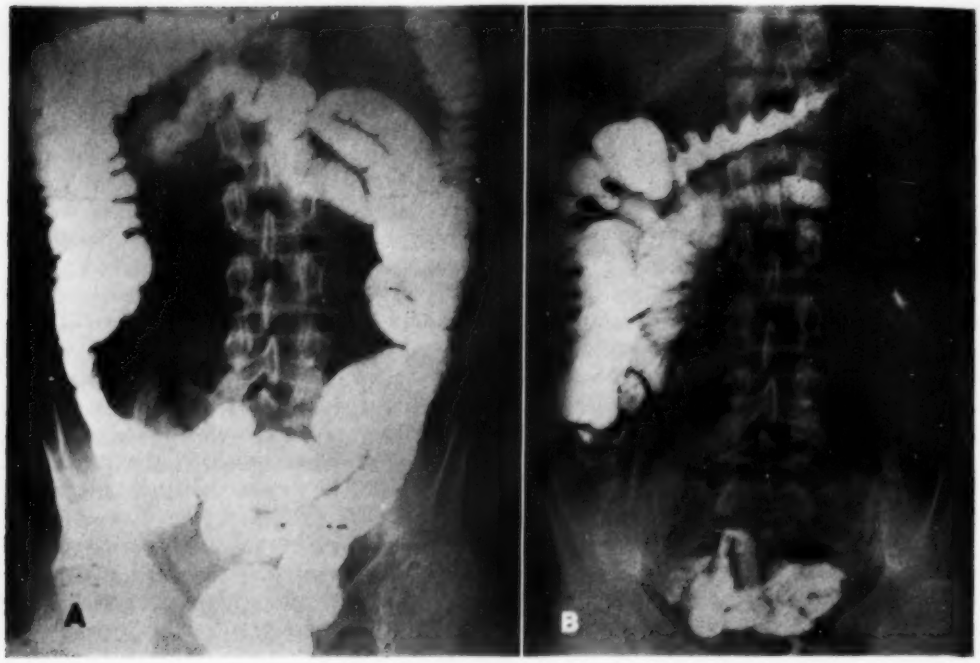

Fig. 1. Case I: Mesenteric lipoma.

A. Barium enema, pre-evacuation roentgenogram. Note the displacement of the loops of small bowel around a central area of lesser density. Lobulation of the mass is suggested by the position of the small bowel, especially the distal portions of the ileum. Extension into the right flank, noted on physical examination, is also demonstrated in this roentgenogram. The radiolucency of the lipoma is evident in the soft tissues to the right of the spine and is also demonstrated by the greater bone detail visible along the right side of the lower vertebrae where they are overlapped by the tumor.

B. Post-evacuation roentgenogram. The area of increased translucency representing the lipoma has shifted slightly to the left and now occupies a more central position. Again the characteristic radiolucency of this tumor can be noted by comparing the fine bone detail seen in the lower lumbar vertebrae with the less distinct bony structure both above and below the mass. The marked contrast between the lipoma and the more dense surrounding soft tissues is well demonstrated along the superior edge of the tumor.

Therefore, the most distinct difference in radiographic density will occur in roentgenograms made at the lowest voltages possible and in the larger tumors which are surrounded by enough soft tissue to supply contrast. The comparative absorption of fat in relation to water is less than one for any heterogeneous x-ray beam generated at from 25 to 95 kv. Even though the technical factors are correct, there are still two conditions in which lipomata may fail to be visualized in the roentgenograms; they may have such an abundant stroma of water-containing tissue that the total absorption will be but slightly different from water, or they may simply lie upon the normal tissues instead of displacing them and thus superimpose their own shadows upon the shadows of the normal tissues.

The roentgen findings in a case of mesenteric lipoma are presented and contrasted with the roentgen findings in a case of mesenteric cyst.

CASE REPORTS

CASE 1: T. H., a 26-year-old white male, was discharged from military service in May 1945 after his left leg had been amputated at the knee following a gunshot wound. In February 1949, he consulted his family physician because of mild constipation, which lasted only a few days. On examination of the abdomen, the physician discovered a mass near the umbilicus, but roentgenograms, including a barium enema study, demonstrated no tumor.

The patient was admitted in May 1949 because the mass was slowly increasing in size. There had been no change in bowel habits, no urinary symp-

toms, and no abdominal pain. The appetite had remained good, and no weight loss had been observed.

The abdomen was soft and flat. There was a large mass, about 12 cm. in diameter, in the hypogastric region, with an apparent prolongation into the right flank. The mass appeared somewhat cystic and seemed to transmit pulsations. It was freely movable transversely but not in any other direction. Laboratory examination of the blood and urine was negative except for a slight trace of albumin in the urine. There was no evidence of blood in the stools.

A barium enema study demonstrated displacement of the barium-filled loops of small intestine around a large central mass, which appeared to be lobulated (Fig. 1A). This mass was easily palpable during the examination and could be moved from side to side. The prolongation into the right flank noted on physical examination was also demonstrated roentgenographically. The post-evacuation film again showed the large, lobulated central mass with the small bowel displaced around it (Fig. 1B). The mass had shifted slightly to the left at this time. In both of these roentgenograms the area representing the tumor was of lesser density than the surrounding soft tissues. This decrease in radiographic density was clearly demonstrated both by contrast with the neighboring soft tissues and by the marked increase in bone detail visible in those portions of the vertebrae overlapped by the mass.

Intravenous pyelography showed both kidneys to be normal in position, and there was no displacement of the ureters. It is interesting that the kidney studies, taken in the supine position, failed to demonstrate the tumor as an area of decreased density, while it was clearly evident in the colon films made in the prone position. Evidently the compression of the abdomen caused by the prone position was necessary to delineate the lipoma.

At operation, May 25, 1949, a large, multiloculated lipomatous tumor was found, involving the mesentery of the small bowel in the region of the terminal ileum and extending from the root of the mesentery to within one inch of the bowel. Frozen sections were reported as simple lipoma. Since the tumor could not be removed without jeopardizing the vascular supply of the terminal ileum, 3 feet of this portion of the small bowel was resected. The ileocolic vessel was not involved in the tumor, so the most distal foot of the terminal ileum was left intact and an end-to-end anastomosis of the small bowel was performed. In freeing the tumor at the root of the mesentery, the duodenum was found to be adherent to the mass. There were several small lipomatous tumors in the mesentery of the jejunum and upper ileum, but no attempt was made to remove these smaller tumors. There was no evidence of any retroperitoneal tumor. Following the operation, convalescence was uneventful.

Pathological examination of the surgical specimen revealed a segment of ileum with attached mesentery. In the mesentery was a mass measuring 16 × 11 × 6 cm. It was lobulated, and cut sections showed it to be yellowish-white and to have the gross appearance of fat. Microscopic sections showed the tumor to consist primarily of fat, with a few dilated lymph spaces and a few bundles of smooth muscle. *Diagnosis:* Lipoma of the mesentery.

CASE II: J. S., a 59-year-old white male, was admitted May 3, 1949, with a history of a slight change in bowel habits and a sensation of pressure in the right upper quadrant for five months. He had noted that the diameter of his stools had decreased and that he had slight constipation. There had been no diarrhea, tarry stools, or abdominal pain. There were no urinary symptoms.

Physical examination showed the abdomen to be soft and relaxed, with a fairly well defined mass in the right upper quadrant. The lower border of the mass was just below the level of the umbilicus, its medial border was at the midline, its superior border was slightly below the costal margin, and it terminated laterally midway between the mid-clavicular and anterior axillary lines. The mass was found to be slightly movable. Routine laboratory examination of the blood and urine was within normal limits. There was no evidence of occult blood in the stools.

An anteroposterior roentgenogram of the abdomen disclosed a rounded area of increased density lying to the right of and partially overlapping the lumbar spine (Fig. 2A). The psoas and kidney shadows were less distinct on the right side but appeared grossly normal otherwise. Intravenous pyelography showed both kidneys to be normal in position and function. The ureters were also normal. A roentgenogram made three hours after the ingestion of a barium meal again demonstrated the round area of increased density lying within the hepatic flexure of the colon (Fig. 2B). There was considerable barium in the small bowel at that time, and the loops were displaced medially by the mass. The ascending and transverse portions of the colon were delineated by barium and gas, and it was observed that the mass displaced the hepatic flexure superiorly. Barium enema examination was performed, and the same findings were clearly demonstrated in the post-evacuation film.

On May 16, 1949, the abdomen was entered through a right transverse incision. A large mesenteric cyst was present in the mesocolon, just below and medial to the hepatic flexure. No vessels were involved in the mass. The cyst was easily enucleated. Following operation, the course was satisfactory, and the patient was discharged on the eleventh postoperative day.

The specimen consisted of a rounded cystic mass 9 cm. in diameter. When opened, it was found to contain a clear, watery fluid; the wall measured less than 1 mm. in thickness. Microscopic sections

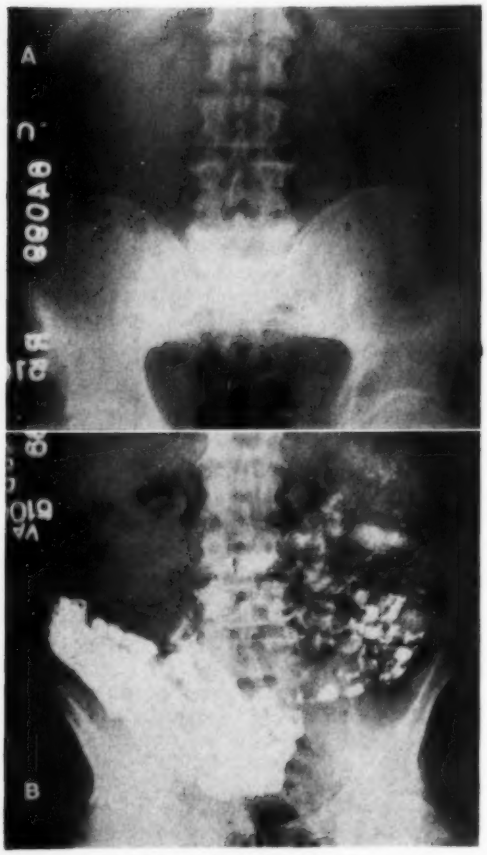

Fig. 2. Case II: Mesenteric cyst.

A. Anteroposterior roentgenogram of the abdomen, showing a rounded area of increased density on the right side. This is outlined partially by the small amount of gas present in the adjacent bowel and partially by its own density superimposed upon that of the usual soft tissues of the abdomen. The decreased translucency of this mass is indicated by the less distinct transverse processes on the right side of the lower lumbar vertebrae and also by the less distinct psoas muscle outline on the right side of the abdomen. Hypertrophic arthritis of the lumbar spine is also present. The dark areas to the left of the spine represent artifacts.

B. Small-bowel examination, three hours after ingestion of a barium meal. The mass can be seen to lie within the loop of the hepatic flexure. The small bowel is displaced medially. The ascending portion of the colon is delineated partially by barium and partially by gas, while the course of the transverse colon can be traced by the contained gas.

showed the lining to consist of flattened cells with moderately large oval nuclei, which probably represented mesothelial cells. The wall was composed of fibrous connective tissue with a few blood vessels and a small amount of fat. *Diagnosis:* Serosal cyst.

DISCUSSION

The above case of mesenteric lipoma (Case I) presents several features previously described by other authors as suggestive of a tumor of the mesentery: the painless abdominal mass first detected by a physician four months before admission for definitive treatment, the suggested lobulation of the mass and its mobility in a transverse direction, and the roentgen exclusion of possible kidney or intrinsic bowel pathology. In addition, roentgenograms of this patient showed an area of relative radiolucency, indicating the fatty nature of the mass. This important roentgenographic finding, based on the differential absorption of roentgen rays by fat and by tissues having a high water content, has been described in lipomata arising in many locations, including the retroperitoneal region, (3, 5, 9, 16, 17, 18) but, in a review of the literature, we have not been able to find a report concerning the roentgenologic features of a lipoma arising within the mesentery proper (1, 6, 10, 14).

The case of mesenteric cyst is strikingly similar to the lipomatous tumor in many respects, including the history, physical findings, and the displacement of the bowel by an extrinsic mass as demonstrated by the roentgenograms. But there is one important roentgenographic variation: whereas the lipona was demonstrable as an area of increased radiolucency, the mesenteric cyst casts a shadow that was more dense than that created by the surrounding tissues.

SUMMARY

Mesenteric tumors are comparatively rare, but should be considered in the differential diagnosis of an abdominal mass, especially if the mass is mobile. The symptoms and physical findings are dependent upon the size and location of the tumor. The cystic form of mesenteric tumor is more frequent that the solid variety. Of the benign solid mesenteric tumors, lipomata are the most numerous.

Lipomata arising in tissues other than the mesentery have been diagnosed by their

characteristic radiolucency, which causes them to stand out from the surrounding tissues.

A case of mesenteric lipoma with distinctive roentgenographic characteristics which pointed to the fatty nature of the tumor has been reported and is believed to represent the first true mesenteric tumor of this type in which characteristic roentgen features have been described. The roentgen findings of this case are contrasted with a case of mesenteric cyst in a patient who presented similar clinical findings but whose roentgenograms showed the tumor as an area of increased density.

Whereas in mesenteric tumors in general, the value of the roentgen examination lies mainly in excluding disease of the bowel, gallbladder, or kidney, in cases of lipoma of the mesentery this examination may, in addition, contribute in a more positive manner by indicating the relative radiolucency of the mass.

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SUMARIO

Lipoma Mesentérico: Comunicación de un Caso con Distintivas Características Radiográficas

Los tumores mesentéricos son comparativamente raros, pero hay que considerarlos en el diagnóstico diferencial de toda tumefacción abdominal, máxime si ésta es móvil. Los síntomas y hallazgos físicos dependen del tamaño y de la localización de la neoplasia. Las formas quísticas son más frecuentes que las macizas. De los tumores mesentéricos sólidos benignos, los lipomas son los más numerosos.

Los lipomas asentados en otros tejidos distintos del mesenterio han sido diagnosticados por su típica radiolucencia, que los hace destacar de los tejidos circundantes.

El caso de lipoma mesentérico aquí comunicado parece ser el primer verdadero ejemplo de esta forma en que se hayan descrito típicas características roentgenológicas. Las radiografías revelaron una zona de relativa radiolucencia, indicando la naturaleza adiposa de la tumefacción. Un caso de quiste mesentérico mostró hallazgos clínicos semejantes, pero roentgenográficamente tomó aspecto de zona de mayor condensación.

Mientras que en los tumores mesentéricos en general el valor del examen roentgenológico estriba principalmente en la exclusión de afecciones del intestino, la vesícula biliar y el riñón, en los casos de lipoma, dicho examen puede además aportar algo más positivo al indicar la relativa radiolucencia de la tumefacción.

Pituitary Irradiation in Prostatic Carcinoma[1]

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THIS IS A REPORT of 30 patients with prostatic cancer who received irradiation to the pituitary gland. Two patients were treated by pituitary irradiation only; 28 by irradiation, orchiectomy, and stilbestrol; 22 by irradiation and orchiectomy.

It was originally planned, in 1943, to irradiate only those patients who had delayed failures following orchiectomy and stilbestrol-induced remissions. For the majority of cases this was true. Obviously, the patients accepted for such treatment were often cachectic and partially crippled by extensive bone metastases. Since most of them were treated as outpatients, and since facilities for hormonal assays were limited, much pertinent laboratory work was omitted. However, this report may encourage other radiologists to investigate the procedure more thoroughly in order to arrive at (*a*) optimum dosage technic, and (*b*) the most favorable time and clinical relationship between pituitary irradiation, orchiectomy, and stilbestrol medication.

DISCUSSION OF ENDOCRINE PATTERN

The rationale of hypophyseal irradiation in prostatic cancer is based upon the directive function exercised by the pituitary gland in the entire endocrine system. Knowledge concerning the hormonal influence on prostatic cancer has increased during recent years, although there are still many unanswered questions concerning the prostate-gonad-adrenal-thyroid-pituitary relationship.

Huggins (1) has stated that "the antiandrogenic therapy of cancer of the prostate demonstrates that a chemical change in the internal environment of the host has brought about a long continuing regression of a malignant neoplastic process." Since the effectiveness of orchiectomy and stilbestrol wears off within weeks or years, a new method of altering the chemical environment of the host must be found in order to induce another remission or to prolong the beneficial effect of the other procedures.

The epithelial cells of a normal prostate decrease in size and function following orchiectomy. At the same time there is an enlargement of the anterior lobe of the pituitary gland without significant influence upon either the intermediate or the posterior lobe (Selye, 2, *a*). Gonadotrophin production is increased, as shown by its increased elimination (Wolfe and Brown, 3).

Levin (4) quotes Kukos, Osterreicher, and Saethre as reporting that hypogonadism in men, particularly when accompanying aging, leads to increased excretion of gonadotrophin. Severinghaus (5) has shown that, in the event of a deficiency or an absence of gonadal function, the anterior pituitary increases in size and shows definite histologic signs of activation. Scott and Vermeulen (6) demonstrated an increase of 5 to 80 per cent in gonadotrophin excretion in three patients with prostatic cancer after castration.

Gonadectomy induces certain changes in the adrenal cortex. The x-zone, which is prominent in adult females but absent in males, is thought by some to be the source of adrenal androgens. Orchiectomy causes this zone to appear and develop, and the administration of testosterone to the castrate causes the zone to disappear. However, in hypophysectomized animals this effect will not take place. Selye (2, *b*) intimates that the effect must be by way of the anterior pituitary gland. Jones (7), although believing that the action of the

[1] From Roswell Park Memorial Institute, Buffalo, N. Y. Presented at the Thirty-sixth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 10–15, 1950.

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testosterone is a direct one upon the x-zone of the adrenal, agrees that a steroid type hormone is secreted by some part of the adrenal cortex. After castration, there is a preliminary fall of total 17-ketosteroids, followed by a subsequent increase. Scott and Vermeulen attribute this to increased adrenal activity.

When the pituitary gland is depressed through disease, as for example, Simmond's disease, the 17-ketosteroid elimination in the urine falls to low levels. High levels, on the other hand, are found in Cushing's syndrome, acromegaly and adrenocortical hyperplasia and tumors. The relationship of the pituitary to the adrenal glands is graphically shown by a case of Means (8). Out of 9 cases of myxedema coming to autopsy, 8 showed nothing abnormal in the adrenals. In the ninth case there was atrophy of the adrenal cortex and also a hypophyseal lesion (cystic degeneration) which had completely destroyed the gland, thus accounting for the adrenal atrophy.

Experience has shown that stilbestrol will often give beneficial results in the treatment of prostatic cancer, although its effect is not always too prolonged. Joel (9), on the basis of his studies with male albino rats, reported that inhibition of the gonadotrophic function of the anterior lobe of the pituitary with subsequent atrophy of the sex organs is caused by female sex hormones. He emphasized the fact that, whereas he succeeded in producing entirely normal conditions again in the testis by administration of male hormone, "the pituitary gland always showed some effect of the female hormone action in the form of hypertrophied chromophobes." This is in accord with Selye's (2, *c*) opinion that folliculoids depress the gonadotrophin production of the animal's own pituitary gland. Zondek (10) claims that the reaction of a human anterior pituitary to the administration of estradiol benzoate, 100,000 units daily for sixty days, "is that of marked increase in the number of eosinophilic cells." At autopsy, an eosinophilic hyperplasia ("adenoma") was found occupying half of the entire lobe. Allen and Bern (11) state that diethylstilbestrol causes an enlargement of the adrenal cortex in the male and female guinea-pig and causes a reduction in the size of the testes to one-quarter of the normal weight. Their experiments showed that injections of a large amount of estradiol benzoate into hypophysectomized rats caused no effect upon the adrenal gland unless anterior pituitary material was given simultaneously.

Throughout the literature there is some degree of ambiguity regarding the physiologic and histologic evidence of pituitary reaction to stilbestrol under different endocrinologic conditions. Perhaps future reports will clarify this situation.

From the experimental and clinical observations just recorded, it is obvious that a depression of pituitary function would serve to decrease androgen production. Huggins and Scott (12) have shown that human prostatic cancer cells may be or may become androgen-independent. In such instances any antiandrogenic therapy would prove of no avail.

EFFECT OF RADIATION ON THE PITUITARY GLAND

There are many accounts of the clinical effect of irradiation of the pituitary gland in man and in experimental animals. The dosage and the technic of delivery, however, are not always clear. Lawrence, Nelson, and Wilson (13) concluded that the pituitary of various laboratory animals is relatively radioresistant and is not permanently damaged by the doses delivered, as was shown by a gradual return to normal or almost normal structure and function. However, there was a suppression of growth, inhibition of ovarian activity, and an atrophy of the thyroid and adrenal glands (cortical tissue mainly). The adrenal change following pituitary irradiation is much less severe than that which follows surgical hypophysectomy. Lawrence and his associates cite the possibility that such changes may have been due in part to disturbed neurohypophyseal rela-

tions through damage to the hypothalamus. Their paper clearly demonstrates that irradiation can definitely depress the activity of the pituitary gland.

Baidins, Claesson, and Westman (14) reported work done on female infantile white rats. With heavy irradiation (6,000 to 10,000 r in air) to the head, severe cachexia progressing to death resulted. There was a decrease in size and weight of the pituitary and ovaries but no cytological changes directly attributable to irradiation.

Selye (2, *d*) states that "in man the pituitary is rather sensitive to x-ray treatment, and temporary castration may result from irradiation of the hypophyseal region." Crooke (15) cites two cases of basophilism reported by Pattison and Swan, plus one case of his own, showing remarkable recoveries after implantation of radon seeds into the pituitary gland. The radon dose was estimated to be about 6,000 gamma r. Crooke also examined the pituitary glands from a number of patients with inoperable brain tumors who had been treated with x-ray, usually about 1,600 r tumor dose, directed to the base of the brain, but he saw no changes which could be attributed to irradiation.

Peirce and Bouchard (16) consider that irradiation of the pituitary gland has considerable to offer in chromophobic and eosinophilic adenoma cases, possibly also in the mixed tumors. They have not observed, either in these patients or in a large series of cerebral tumors, any sign of radiation damage to the brain nor induced hypopituitarism.

Bromley (17) reports excellent clinical relief following x-ray therapy in some cases of basophilic hyperpituitarism. He noted marked relief from mental distress and depression almost as soon as treatment was begun. He also cites the fact that x-rays can relieve headaches of presumed pituitary origin, as shown by the treatment of acromegaly, where striking relief of headache often occurs early in the course of treatment, "long before any dose has been given which could affect the macroscopic size of the adenomatous tumor." Bromley believes that in menopausal and castration conditions the characteristic symptoms due to pituitary hyperplasia and over-activity were appreciably modified by pituitary irradiation.

It is definitely known that irradiation can cause some functional alterations in the pituitary gland. Histologic evidence of changes in human pituitaries following moderate radiation dosage has not been reported. This should be more thoroughly investigated. It could be that attention to this detail has not been very searching. In the series of cases to be recorded here only 2 patients died in the Institute and in neither one was the pituitary gland included in the postmortem examination.

TECHNIC OF IRRADIATION

The irradiation factors in this series were:

27 cases: 200 kv.p. (h.v.l. 0.9 mm. Cu)
1 case: 250 kv.p. (h.v.l. 2.5 mm. Cu)
2 cases: 1,000 kv.p. (h.v.l. 9.0 mm. Cu)
Skin ports: Right and left temple upper facial ports; occasionally an additional anterior mid-forehead port.
Port size: 20 to 40 sq. cm.
Skin-target distance:
50 cm. and 80 cm. (200 kv.p.)
80 cm. (250 kv.p.)
70 cm. (1,000 kv.p.)
Daily increments: 200 r or 300 r (with back-scatter) to one port each day. This increment was often started at 300 r and decreased to 200 r if patient complained of any cerebral symptoms.

The total dose at the sella turcica area was estimated from individual skull measurements and depth isodose curves derived from water phantom calibrations with a Victoreen condensor "r" meter. Actual experimental skull measurements were made by Mr. Melvin Reinhard, physicist, using rice as a scattering medium inside the cranial cavity. The findings were as follows: At 6.5 cm. depth (at the sella) there was no significant departure from the water-phantom depth values for

x-ray qualities of h.v.l. 9.0 mm. Cu or h.v.l. 5.0 mm. Cu. At h.v.l. 0.9 mm. Cu there was a 20 per cent increase over the water-phantom values. At h.v.l. 2.5 mm. Cu there was approximately a 10 per cent increase over water-phantom values. The depth doses quoted in this report are water-phantom values. Actual "scattering-at-sella" values may be obtained by using the correction factors just given. All r doses are with back-scatter.

The depth doses ranged from 756 r (h.v.l. 0.9 mm. Cu) in twelve days to 4,860 r (h.v.l. 9.0 mm. Cu) in thirty-five days.

RESULTS

The 30 patients have been grouped according to the time relationship between irradiation, orchiectomy, and stilbestrol administration. Of the 8 patients who did not receive stilbestrol, 2 each were in Group I and Group II, 1 in Group III, and 3 in Group IV. Due to the small number of patients and the varying relationship between the different treatment modalities employed, too detailed averaging of statistics can be unwise and deceptive. The true value of pituitary irradiation should be judged upon individual case reports. Since space will not permit this, the more outstanding examples will be abstracted. Even though the duration of improvement was often short, the method did give comfort to many patients.

Group I: Radiation to Pituitary Gland Only (2 Cases)

X-ray dosage.....*999–1,305 r*
Improved.....*1 (3 months)*
Unimproved.....*1*
Average survival following admission.....*6 months*
Average survival following diagnosis (first treatment).....*6 months*

CASE 1: H. J., 67 years old, was admitted April 30, 1943, with nodular induration of both prostatic lobes and infiltration into the right side of the pelvis. He had severe back pains radiating down both lower extremities. Alkaline phosphatase was 120; acid phosphatase was 19.1. X-ray examination showed metastases in the pelvic girdle.

The radiation dose was 1,305 r delivered in fifteen days (h.v.l. 0.9 mm. Cu). On the fourth day of treatment the pain in the back, hips, and legs had ceased. One month after treatment the patient could walk several hours daily without pain; the prostate had regressed in size and was softer, without any infiltration into the pelvis; the alkaline phosphatase had decreased to 86 and the acid phosphatase to 12.1. Two months after treatment he was feeling well and without pain. The prostate was rather small, with some induration in the right lobe. The alkaline phosphatase was 71.5 and the acid phosphatase 76.5. Three months after treatment the patient fell and injured his back and legs (information from questionnaire). He died nine months following treatment, without further examination.

In this case definite improvement was obtained for three months from irradiation only.

Group II: Radiation Less Than One Month Before Orchiectomy (5 Cases)

X-ray dosage.....*760–3,168 r (average, 1,627 r)*
Improved.....*4*
Unimproved.....*1*
Average survival after admission.....*20 months*
Average survival after diagnosis (first treatment)..*20 months (One still living but not well)*

In this group are included those cases in which the course of roentgen therapy coincided closely with orchiectomy. It is, therefore, almost impossible to credit direct benefit to irradiation.

CASE 4: G. L., 60 years old, was admitted July 16, 1943, with pain in the back and lower extremities, metastases in the pelvis, and urinary complaints. A dose of 792 r was given in seventeen days (h.v.l. 0.9 mm. Cu). This was followed in two weeks by orchiectomy. The patient experienced considerable relief during and immediately after the course of irradiation. Although he was paralyzed from the umbilical level, his general condition continued to improve for about two months. Death occurred eleven months after irradiation. No stilbestrol was given.

This patient showed definite improvement directly attributable to the irradia-

tion, although orchiectomy must share in the credit for the post-irradiation relief.

Group III: Radiation More Than One Month Before Orchiectomy
(3 Cases)

X-ray dosage.....*891–3,096 r (One case was given two courses at five-year intervals)*
Improved.....*3*
Average survival after admission.....*51 months*
Average survival after diagnosis (first treatment)..*51 months*

CASE 8: J. B., 84 years old, was admitted July 19, 1943, with metastatic nodes in the left groin (biopsy confirmed). A pituitary dose of 1,485 r (h.v.l. 0.9 mm. Cu) in seventeen days was given, beginning on admission. The patient improved markedly and gained weight. One month after the hypophyseal irradiation the nodes in the groin were no longer palpable (Sept. 9, 1943). One month later administration of stilbestrol was commenced even though the patient's condition was improving. In December 1945 (four months after irradiation), he began to have pain in the left lower extremity and hip. By March 1944, the pain had increased and there was roentgen evidence of metastases in the pelvis and lumbar vertebrae, as well as a return of a metastatic node in the left groin. Orchiectomy was performed March 14, 1944. On March 25 the metastatic node in the groin had regressed, and on April 24 it was no longer palpable. On Nov. 6, 1944, the patient had no pain or other complaints, and the prostate gland had decreased in size. In July 1945, he felt too tired to visit the Institute, although he had no other specific complaints. In December 1945, his physician wrote that he had no evidence of metastases. Death occurred July 5, 1946, at the age of eighty-seven years.

This case illustrates very well the efficacy of hypophyseal irradiation.

CASE 9: W. F., 82 years old, was admitted May 12, 1943, with pain in the right hip and urinary distress. He received a dose of 891 r in ten days (h.v.l. 0.9 mm. Cu) followed by three months of relief of pain, allowing him to walk without difficulty. Administration of stilbestrol (1 mg. twice a day) was then started and one month later orchiectomy was carried out. Improvement followed and was maintained for almost five years, after which pain in the back and hips, with difficulty in walking, recurred. At this time a second course of irradiation was given. A dose of 2,106 r in twenty-four days (h.v.l. 0.9 mm. Cu) gave relief for a few weeks. The patient had less pain and walking was easier. Death occurred five months after this second course.

This patient showed improvement after each course of radiation.

Group IV: Radiation More Than One Month After Orchiectomy
(20 Cases)

X-ray dosage.....*756–4,860 r (One patient received two courses 13 months apart; 1 three courses with intervals of 13 and 18 months)*
Average dose.....*2,857 r*
Improved.....*15*
Unimproved.....*5*
Average length of improvement following x-ray in 20 cases.....*4.2 months*
Average length of improvement following x-ray in 15 improved cases.....*8.4 months*
Average survival following x-ray (20 cases).....*15.6 months*
Average survival following x-ray (15 cases showing improvement).....*18.7 months*
Average survival following admission.....*30 months*
Average survival following diagnosis (first treatment).....*36 months (One still living but not well)*

CASE 12: S. W., 69 years old, was admitted March 18, 1942, with backache, loss of weight, emesis, and metastases in the vertebrae. Stilbestrol (1 mg. twice daily) was started on March 18 and orchiectomy was done on April 16, followed by three months of improvement in symptoms and roentgen signs of metastases. On June 8, 1943, x-ray treatment was started. A dose of 756 r in twelve days (h.v.l. 0.9 mm. Cu) gave immediate relief. Pain in the hip disappeared, backache decreased, and the patient was able to work in his garden. The right prostatic lobe decreased in size. Nineteen months later (February 1945) a gradual decline began and death ensued May 1, 1946.

CASE 15: E. F., 69 years old, was admitted Jan. 3, 1944, with urinary distress. X-ray examination was negative for metastases. Orchiectomy had been done two years before admission. X-ray therapy was started on Feb. 8, 1944, a dose of 2,835 r being given in twenty-six days (h.v.l. 0.9 mm. Cu). Marked improvement in the general health and urinary difficulties ensued, both during and for three months following irradiation. Stilbestrol (1 mg. twice daily) was then ordered even though the patient was feeling quite well. Improvement continued until March 1946, when he began to fail. He died April 17, 1947.

Radiation alone is credited for three months relief and with stilbestrol for two years relief in this case.

CASE 16: W. M., 77 years old, was admitted Jan. 12, 1944, with urinary complaints and pelvic metastases. Stilbestrol (1 mg. twice daily) gave urinary relief for thirty-nine months, when pain commenced. Orchiectomy on Dec. 20, 1947, was followed by relief for eight months. From Aug. 30 to Dec. 1, 1948, a dose of 3,240 r was given (h.v.l. 0.9 mm. Cu). Treatment took sixty-two days because of a twenty-three-day interruption for a hospital bed. During and following treatment, pain decreased to such a degree that the patient could walk much better. He had no specific complaints for a minimum of two months, when he began to fail. Death ensued Oct. 2, 1949. The relief from irradiation was dramatic.

CASE 22: J. W., 49 years old, was admitted Nov. 20, 1944, with metastases in the pelvis and with pain in the right lower extremity. Stilbestrol (1 mg. twice daily) was started and on Nov. 22 orchiectomy was done. The patient improved for three months, when symptoms returned. From March 9 to April 11, 1945, a dose of 3,570 r was given (h.v.l. 0.9 mm. Cu). Improvement followed irradiation, continuing until April 1946, when pain in the back and right hip developed. A second course of x-ray treatment was given from May 31 to July 3, 1946. The dose was 3,660 r (h.v.l. 0.9 mm. Cu). During treatment the pain in the back and hip disappeared. In October 1946 the patient still felt well except for occasional pain on exertion. In July 1947, he had no pain and had gained weight. In January 1948, he began to have gradually increasing pain in the back and lower extremities. A third course of x-ray therapy from Feb. 25 to April 2, 1948, for a dose of 2,460 r (h.v.l. 0.9 mm. Cu) gave no relief. Death occurred Sept. 15, 1949.

This case illustrates beneficial results following the first and second courses of irradiation. The first course gave relief for twelve months, and the second for eighteen months. The third course failed.

CASE 23: T. S., 48 years old, was admitted Oct. 1, 1945, with metastases in the pelvis, pain in the back, weakness, and loss of weight. Stilbestrol (1 mg. twice daily) was started on Oct. 4. After six months of improvement, the patient complained of pain in his right shoulder, chest, back, and hips Orchiectomy on May 3, 1947, gave relief for three months. Irradiation was given from Nov. 3 to Dec. 14, 1948, a dose of 4,384 r being delivered (h.v.l. 0.9 mm. Cu). It was followed by relief from pain for six months. The prostate decreased in size. Death occurred Jan. 13, 1950.

This patient obtained a longer relief from pain with irradiation than he did following orchiectomy. Improvement lasted six months.

CASE 24: L. H., 62 years old, was admitted Feb. 25, 1949, with metastases in the pelvis, pain in the back, and perineum. Stilbestrol had been started in February 1948 and orchiectomy was done on March 16, 1948. Slight improvement was obtained until January 1949. Radiation therapy was given from Feb. 28 to April 7, 1949, for a dose of 3,120 r (h.v.l. 0.9 mm. Cu). Pain was relieved and the general condition improved until October 1949 when opiates were required. The patient is still alive.

In this case there was remarkable relief for at least six months.

DISCUSSION

It is interesting to compare the over-all end-results in our cases with larger series treated differently. Five of our patients had had orchiectomy or treatment with stilbestrol before admission to the Roswell Park Memorial Institute (average time 17.6 months). For comparison, therefore, the average survival is computed from both admission date and from first treatment date. Gahagan and Fischman (18), in a series of 172 traced patients (52 patients not traced were not included) treated by orchiectomy or stilbestrol, reported an average survival time, after diagnosis, of 26.3 months. If absolute statistics are used (172 traced plus 52 untraced and considered dead) the average survival in their series is 20.2 months. Nesbit and Plumb (19) reported an average survival time of 21.2 months after diagnosis in 737 patients, known to be dead, treated by non-endocrine methods.

The average survival time for the 30 cases in this report was 29 months following admission to this Institute, and 32.6 months following first treatment (orchiectomy and/or stilbestrol and/or pituitary irradiation). The 20 cases in Group IV (pituitary irradiation following failure of orchiectomy and stilbestrol) showed an average survival of 36 months following first treatment (orchiectomy or stilbestrol) and 30 months following the first visit to this Institute.

In a study of 213 patients who were treated originally with one form of therapy alone (either castration or estrogen) and then received the other form of therapy for relapse, Nesbit and Baum (20) reported an average survival of 9.6 months after the onset of the relapse. In our group of 20 patients (Group IV) who were treated by pituitary irradiation following relapse after orchiectomy alone (3 cases) or orchiectomy plus stilbestrol (17 cases), the average survival after relapse was 15.6 months. Statistical significance is not claimed for this figure, because of the small number of patients.

Favorable responses have occurred in all dosage ranges. Due to the fact that depth doses under 1,000 r have produced amelioration of symptoms in some instances, and since experimental and clinical evidence suggests that the pituitary gland may recover from the effect of irradiation, it would be worth while treating a series of patients with repeated courses of such small doses when relapses occur. Repeated large doses would, of course, create treatment problems, but under certain conditions would be worth testing, as exemplified in Case 22. The scheme of adrenal gland irradiation in addition to pituitary irradiation is now being investigated.

CONCLUSION

Pituitary irradiation is of definite palliative value as an adjunct to orchiectomy and stilbestrol in treatment of prostatic carcinoma. The rationale of this procedure is justified on the basis of experimental and clinical evidence. Determination of an optimum dosage technic and time relationship to orchiectomy and stilbestrol must await further exploration by radiation therapists.

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SUMARIO

La Irradiación Pituitaria en el Carcinoma Prostático

La irradiación hipofisaria ha resultado ser de valor paliativo bien definido como coadyuvante de la orquiectomía y el estilbestrol en el tratamiento del cáncer de la próstata. Las razones de esta terapéutica se basan en pruebas experimentales y clínicas de que una depresión de la función pituitaria disminuye la producción de andrógeno.

Al comunicar una serie de 30 casos, agréganse típicas historias clínicas. De 2 enfermos que solamente recibieron irradiación pituitaria, 1 mejoró por espacio de tres meses. En 5 casos, la tanda de radioterapia fué seguida en menos de un mes de la orquiectomía. En este grupo, 4 pacientes mejoraron, pero como los dos procedimientos casi coincidieron, no puede justipreciarse el efecto de la irradiación. Tres enfermos recibieron irradiación por más de un mes antes de la orquiectomía, y todos mejoraron. En el grupo más numeroso, 20 casos, se administró irradiación después de una recidiva consecutiva al tratamiento anterior con orquiectomía y estilbestrol. En 15 casos, obtúvose mejoría que duró un promedio de 8.4 meses; 5 casos no mejoraron. En este grupo, la sobrevivencia media consecutiva al tratamiento primitivo duró treinta y seis meses.

La determinación de la dosis óptima de irradiación y de la relación cronológica con la orquiectomía y la administración de estilbestrol exige mayor estudio de parte de los radioterapeutas.

DISCUSSION

Harold W. Jacox, M. D. (New York): We have just heard an excellent presentation of a new and different clinical experimental approach to the difficult and distressing problem of cancer of the prostate gland. It is obvious that orchiectomy and estrogen therapy are not the final answer to this problem. The effectiveness of further treatment after relapse has been the concern of all physicians who treat this condition.

Dr. Murphy's endocrinology is correct. I have talked with my endocrinologist friends and they say it is absolutely right. Experimentally there is evidence of pituitary control over the adrenal glands and the gonads. There is also evidence that removal of the gonads is followed by changes in the steroids of the urine, which later return to the approximate former levels. This effect has been presumed to be produced by the adrenals through the pituitary.

The experimental evidence obtained in some animals is supposed to correlate in some degree with observations in human beings of the changes caused by disease and by surgery. From these findings, reduction of pituitary function would suggest a reduction in replacement following ablation of the gonads. How successfully this can be attained in the human being by irradiation of the pituitary will be determined by further work of Dr. Murphy and others in this field.

Dr. Murphy's average survival figures of more than fifteen and a half months certainly compare favorably with Nesbit's and Baum's report of more than nine and a half months in a study of 213 patients originally treated by one method alone and then treated for relapse by the other form of therapy. The combined study of 1,818 cases reported by Nesbit and Baum last August for the urosurgical group showed that removal of the gonads alone or estrogenic therapy alone did not give as favorable results as both combined. That is an important observation. They found that the maximum benefit was best achieved by the institution of treatment as soon as the diagnosis was established.

A similar large series with pituitary irradiation will be interesting for a comparison of end-results. I hope Dr. Murphy and his group will continue this study and that others will try it, also.

Roentgen Therapy of Pituitary Adamantinomas (Craniopharyngiomas)[1]

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A PITUITARY ADAMANTINOMA is an encapsulated cystic tumor containing muddy-looking fluid filled with cholesterol crystals and grumous material. The weight of evidence at present is strongly in favor of the derivation of this tumor from embryonic epithelial rests in the pars tuberalis of the pituitary body. This portion of the pituitary arises from an ectodermal outpouching of the roof of the primitive mouth cavity, and it is probable that dental elements and transitional forms of epithelium are enclosed in this outpouching. Although pituitary adamantinomas resemble embryonic enamel organs microscopically, no enamel or evidence of enamel formation is found in these tumors. One is justified, however, in speaking of them as resembling the embryonic enamel organ, and, since the term "adamantinoma" is descriptive, it probably is the best designation.

Pituitary adamantinomas present one of the most difficult problems in neurosurgery. The close anatomic relationship of vital structures which are intolerant to trauma makes successful excision an extremely difficult procedure. It is only natural, therefore, that more conservative methods of treatment have been tried. On the basis of their microscopic structure, these tumors would appear to be radioresistant, and indeed they have been considered so by the majority of radiologists. Most of the reports in the literature are unsatisfactory, since they concern cases in which the diagnosis has not been verified and in which, for the most part, the tumors have been unresponsive to roentgen therapy.

Bailey (1), in his review of 242 verified tumors of the brain in which roentgen therapy was used, said that suprasellar cysts were not treated, since no results were to be expected from irradiation. Béclère (2) also considered tumors of Rathke's pouch and all suprasellar tumors refractory to roentgen therapy.

It was not until 1937 that any report was published concerning the favorable results of roentgen irradiation of histologically verified pituitary adamantinomas. Carpenter, Chamberlin, and Frazier (3) reported 4 cases in which the improvement produced by roentgen therapy was definitely greater than that obtained by surgical measures alone. In 3 of these cases the diagnosis was verified histologically, but in the fourth case irradiation was used after the cystic tumor was aspirated. The authors' conclusion was that, even though the tumor might not be destroyed by roentgen rays, the tumor cells which produced the secretion forming the cyst seemed to have their secretory character destroyed by irradiation.

In 1938 Schwartz (9), in his article on tumors of the hypophysis, said that roentgen therapy of pituitary adamantinomas was moderately successful. He felt that the method of treating these tumors should be essentially the same as for other pituitary tumors except that the dosage should be reduced in young patients.

Dyke and Davidoff (4), in their book *Roentgen Treatment of Diseases of the Nervous System*, reported their experiences with roentgen therapy in 5 cases of pituitary adamantinoma. In only 3 could remission or improvement of symptoms be definitely attributed to irradiation.

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Ingraham and Scott (5) stated that there would seem to be sufficient evidence to warrant further trial of roentgen therapy in the treatment of this tumor, but they expressed the opinion that the results of such treatment should be evaluated critically. They pointed out that the issue would not be clarified and that the patient might suffer loss of visual function if the irradiation were carried out before biopsy was performed. They also suggested that those patients with early recurrence of symptoms following partial excision of the tumor and without contraindications, such as serious reduction of visual acuity, might best be treated by withholding operation and instituting roentgen therapy.

Kaplan (6) has expressed the opinion that postoperative roentgen irradiation is of value in cases of pituitary adamantinoma.

According to Kerr (7), a pituitary tumor should not be treated with roentgen rays if it is suspected that the tumor is cystic, if hemorrhage has occurred into the tumor, or if there has been an increase in intracranial pressure. It is almost universally agreed, he says, that it is futile to irradiate a pituitary tumor that is cystic.

MATERIAL

In a period of thirty-two years, from Jan. 1, 1916, to Dec. 31, 1947, inclusive, 108 cases of pituitary adamantinoma were observed at the Mayo Clinic. In 100 of these cases, the diagnosis of pituitary adamantinoma was made by microscopic examination at the time of operation or at necropsy.

In this series of 100 cases, the tumors occurred most commonly in the second decade of life; in 47 per cent of the cases, however, the patients were more than twenty years of age. Headache and loss of vision were by far the most common symptoms. Roentgenographic examination disclosed calcification of the tumor in 56 per cent of the cases, whereas microscopic examination revealed calcification in 77 per cent. A detailed report of the clinicopathological features and surgical results in these 100 cases has been published elsewhere (8).

Roentgen therapy was employed in 15 cases. In 2 of these, it was used prior to operation; in 2, it was used both before and after operation; in the 11 remaining cases, it was used only postoperatively. In 2 cases in which roentgen therapy was used soon after operation, the patients were free of symptoms for one year, but there is no way of determining what role irradiation played in the relief of symptoms in these cases. Roentgen therapy was apparently without effect in 2 cases, and in another case follow-up data were not available. In the remaining 10 cases, relief of symptoms could be definitely attributed to the irradiation. We shall present a brief summary of the pertinent data in these 10 cases.

REPORT OF CASES

CASE 1: A man aged 29 years came to the clinic on June 21, 1939. He had suffered from headache, nausea, and vomiting for approximately one year. The severity of the headache had increased progressively, and when the pain had been most severe it had been associated with visual blurring. Examination disclosed a relative bitemporal hemianopsia. Vision was 6/10 in the left eye and 3/60 in the right eye. Roentgenograms of the head and thorax, as well as routine laboratory tests, did not show any abnormality.

A right transfrontal craniotomy revealed a fairly large intrasellar tumor containing 10 c.c. of thick yellow fluid, and a partial resection was performed. Microscopic examination showed the tumor to be a pituitary adamantinoma.

Convalescence was marked by drowsiness, which slowly improved, and by symptoms of diabetes insipidus. At the time of the patient's dismissal on July 19, 1939, his vision was 6/12 in the left eye and 6/60 in the right eye.

The patient returned to the clinic three months later because of a recurrence of headaches. Examination disclosed bitemporal hemianopsia and a definite progression in the visual defects. A left transfrontal craniotomy revealed a cystic tumor in the sella turcica. An extensive resection was done. Microscopic examination showed typical pituitary adamantinoma. Except for moderate thirst, which was controlled with insufflations of pituitary powder, convalescence was uneventful. When the patient was dismissed on Oct. 24, 1939, the defects in the visual fields had improved.

One week later, the patient was again seen in the clinic, complaining of severe headache and drowsi-

ness. Roentgen therapy was employed at that time. Six portals were irradiated (two in each temporal area, one in the vertex, and one in the frontal area). The total surface dose was 3,000 r, while the tumor dose was 1,500 r. The factors were as follows: 200 kv., 20 ma., 0.75 mm. copper and 1 mm. aluminum filter, distance 50 cm., time twenty-one minutes.

When the patient returned to the clinic for a check-up on Dec. 1, 1939, he was free of headache. The extent of the bilateral hemianopsia was the same as it had been at the time of his previous visit, and he still was using insufflations of pituitary for the diabetes insipidus. In the following year, his vision began to fail and he was given another course of roentgen therapy in his home town, but all that is known of this course is that treatment was given daily for one month.

In November 1943, the patient stated in a letter that his vision was 20/20 with glasses and that examination of the visual fields had disclosed only a slight notching in the upper nasal sector of each eye. In August 1948, more than nine years after his first operation, he wrote that he was in good health, that he was working every day, and that he had no visual difficulties.

Comment: This patient received his first course of roentgen irradiation only one week after dismissal from the hospital following his second operation. His symptoms at that time were those of increased intracranial pressure, and it is probable that the roentgen therapy resolved adhesions which were obstructing the flow of cerebrospinal fluid. It would seem doubtful that any recurrence of tumor growth or re-formation of a cystic tumor could have taken place in so short a time. However, when vision again failed in 1940, roentgen therapy apparently resulted in an inhibition of tumor growth or formation of cystic fluid.

CASE 2: A man aged 31 years registered at the clinic on Aug. 21, 1939. About nine months previously, he had begun to have severe frontal headache. This had increased progressively in severity and recently there had been a gradual loss of vision in the left eye. The patient had gained about 20 pounds (9.1 kg.) in the six months before he came to the clinic, and he had noticed that he was drinking an excessive amount of water.

Examination disclosed a bitemporal hemianopsia, with a central scotoma in the left eye. Vision was 6/60 in the left eye and 6/30 in the right eye. The basal metabolic rate was −23 per cent. Roentgen examination of the head and thorax and routine laboratory tests did not reveal any other abnormality.

In right transfrontal craniotomy, a small cystic intrasellar tumor was found. The capsule was incised and a solid papillomatous nodule was enucleated. Microscopically the tumor proved to be a typical pituitary adamantinoma.

The patient's convalescence was marred by irrational behavior, paranoid ideas, and auditory and visual hallucinations, but these symptoms disappeared within ten days. At the time of his dismissal on Sept. 14, his visual fields had improved; vision was 6/12 in the left eye and 6/20 in the right eye. There was slight pallor of the temporal sides of both disks.

Two months later the vision in both eyes had decreased and the patient was given a series of thirty-six roentgen treatments in his home town. Two contralateral temporal fields were used, both centered on the pituitary body. Each field received a dose of 150 r in air, every other day, and was treated eighteen times for a total dose of 2,700 r in air. The factors were: 500 kv., 3 ma., 7 mm. of copper and 3 mm. of aluminum filter, distance 30 cm., output 20 r per minute. The half-value layer was 9 mm. copper. Three months later, a second course of roentgen therapy was given with the same factors but the dose per field was cut in half, that is, a total dose of 1,350 r in air was given to each field. A similar course was given three months later.

The patient was able to carry on his usual activities until April 1941, when his right eye suddenly became blind. Vision slowly returned, however, and in June 1941 was 6/20 in the right eye and 6/7 in the left. No further treatment was given at this time.

The patient was again seen at the clinic in November 1941, when vision was 6/10 in the left eye and 6/30 in the right eye. There was definite pallor of both disks, and examination of the visual fields disclosed bitemporal scotomas with a relative central scotoma in the right field of vision. There was no roentgen evidence of any change in the sella turcica.

The last report from this patient was received in December 1949, at which time he said that there had been little change in the visual fields or visual acuity and that he was in excellent condition and enjoying normal health.

Comment: From the operative note in this case it must be assumed that some of the wall of the cyst was left behind. In the relatively short period of two months the cyst re-formed, apparently with an accumulation of fluid and a recurrence of visual difficulties. The three courses of roentgen therapy seemingly inhibited any further formation of fluid, and since September 1940 there has been no change in the visual fields or acuity. The sudden blindness which occurred in April 1941,

in the right eye, was thought at the time to be due to an embolus in the central artery of the retina, and the patient was treated at home with glyceryl trinitrate and other vasodilators with apparently good results.

CASE 3: A man 20 years of age was brought to the clinic on Oct. 5, 1939. He had had headaches since childhood, and three years prior to coming to the clinic had noted some blurring of the temporal field of vision of the left eye. This visual difficulty had improved in the past eighteen months. He claimed that he had not been free of severe headache for at least three years.

Examination revealed questionable contraction of the lower part of the temporal field of vision of the left eye. Vision in both eyes was 6/5. Roentgenograms of the head showed an irregular suprasellar calcification, and the pineal body was found to be displaced slightly posteriorly. Routine laboratory studies did not reveal any other abnormality.

The patient's parents did not want him operated on at this time, and so took him home. He was brought back one month later, however, because his headache had become more severe and generalized. Examination at this time disclosed bilateral papilledema of 1 diopter, with several hemorrhages at the edge of the right optic disk. Visual acuity was normal, but there had been a marked progression in the defect of the visual field of the left eye.

A right transfrontal craniotomy revealed a large, partially cystic and calcified tumor which was both intrasellar and suprasellar. According to the surgeon's note, the entire tumor was removed. On microscopic examination it was found to be a pituitary adamantinoma.

Convalescence was complicated by hyperpyrexia early in the postoperative period, but recovery thereafter was uneventful. Following the patient's dismissal on Dec. 20, 1939, his vision improved, and about a year after operation he began to work full time.

The patient returned to the clinic on June 27, 1942, because of left frontotemporal headache, chronic fatigue, and anorexia. His skin was pasty and pale. There was a sparsity of axillary and pubic hair, and the deep tendon reflexes were sluggish. Although there was little change in visual acuity, the right optic disk appeared pale, and examination disclosed partial bitemporal hemianopsia. Because of the hypopituitary symptoms, 25 mg. of testosterone propionate was prescribed to be taken intramuscularly three times a week.

On his return to the clinic on Nov. 12, 1942, the patient showed evidence of spectacular improvement. He was alert and he had gained 30 pounds (13.6 kg.). The growth of hair was definitely heavier. There had been some penile growth, and the voice was more masculine. Vision was 6/7 in the left eye and 6/6 in the right eye. The defects in the visual fields showed remarkable improvement after apparently remaining unchanged for three years. The only apparent reason for the improvement was the testosterone propionate, and continuance of this was advised.

About two years later the patient was again seen in the clinic because of a defect in the temporal field of vision, chronic fatigue, and mild right frontotemporal headache. His desire for fluids had increased. Examination disclosed a left temporal hemianopsia and some slight pallor of the left optic disk. Vision was 6/6 in each eye. He was advised to continue taking testosterone propionate and posterior pituitary was prescribed to control the mild symptoms of diabetes insipidus. A course of roentgen therapy also was advised, and this was given by a home physician, a total of 1,512 r being delivered to each of three portals to cross-fire the region of of the pituitary body. A Thoreus A filter was used with 200 kv., at a distance of 50 cm. Headache soon subsided and improvement continued.

In a letter written more than eight years after his operation, the patient stated that he was in good health, was working part time, and was not taking any type of medicine.

Comment: It is interesting, in this case, to note that the defects in the visual fields improved remarkably after they had remained unchanged for three years. It would seem that the only apparent reason for the improvement was the testosterone propionate. Roentgen therapy was given almost five years after operation and produced excellent results.

CASE 4: A woman aged 41 years registered at the clinic on Jan. 29, 1940. About one year previously, she had begun to suffer from severe frontal headache, occurring once every two or three weeks. She had quit her position as a store executive because of irritability, exhaustion, and nervousness. Two years before she came to the clinic, she had noticed some decrease in vision in her left eye, and her desire for fluids had increased in the meantime.

Examination disclosed a generalized depression of the visual field of the right eye and temporal anopsia of the left eye. The vision in the left eye was 6/7, but with the right eye the patient could see fingers only at 5 feet (152.4 cm.). An electroencephalogram was interpreted as being suggestive of a deep basal lesion.

A right transfrontal craniotomy disclosed an intrasellar tumor. An intracapsular enucleation of the tumor was done. The surgeon was not sure, however, that he had seen the full extent of the lesion. Microscopic examination of the tissue removed showed it to be a pituitary adamantinoma.

During convalescence, posterior pituitary was ad-

ministered by nasal insufflation because of symptoms of diabetes insipidus, but the patient remained extremely drowsy. An encephalogram revealed a tumor in the third ventricle, which partially occluded the right foramen of Monro. Because of the stormy convalescence, re-exploration was not advised. Eight roentgen treatments were given through four portals (bitemporal, frontal, and vertex). The factors were: 200 kv., 15 ma., 1 mm. of copper and 1 mm. of aluminum filter, distance 50 cm. The total tumor dose was approximately 2,000 r. The patient was dismissed April 16, 1940.

When the patient returned to the clinic on June 21, 1940, she was greatly improved. She had gained 40 pounds (18.1 kg.) but was still retarded mentally. There was a slight weakness of the left foot. The vision was 6/12 in the left eye and 6/60 in the right eye. Examination disclosed pallor, grade 2 (on the basis of 1 to 4), of the right optic disk and pallor, grade 1, of the left disk. There was improvement in the central portion of the visual field of the right eye. Eight more roentgen treatments were given at this time through the same portals and with the same factors, for a total tumor dose of 2,000 r.

When the patient was seen for a check-up on Aug. 4, 1948, some postural vertigo was her only symptom. Vision was 6/6 in each eye, and there was pallor, grade 1, of the optic disks. There was no essential change in the visual fields. This check-up was made more than eight years after operation.

Comment: Pituitary adamantinomas that develop with great rapidity may infiltrate the surrounding tissue to such an extent that the dissection of the lesion from adjacent structures is surgically impossible. In this case, the surgeon felt that he had left a portion of the tumor behind. However, even if he had been able to visualize it in its entirety, he probably could not have removed it successfully. Although the encephalogram revealed a large obstructing mass, the patient was greatly improved after only one course of eight roentgen treatments. Eight years after the operation, her only symptom was postural vertigo.

CASE 5: A girl aged 6 years was brought to the clinic on Feb. 5, 1940. She had failed to grow as rapidly as her younger sister. For the past two years she had had repeated episodes of vomiting, an increased desire for fluids, and frequent micturition. Five months before she was brought to the clinic, she had begun to suffer from frontal headache, which had occurred daily for the past month. Four months earlier she had begun to have forceful vomiting after going to bed; for six weeks she had had visual difficulties, and she had been semiconscious for several hours on different occasions.

Percussion of the head elicited a cracked-pot sound. The visual fields were normal, but examination of the ocular fundi disclosed choking of the right optic disk of 4 diopters and choking of the left optic disk of 5 diopters. The vision in each eye was 10/30. The neck was stiff. Roentgen examination of the head revealed marked erosion of the sella turcica and a large amount of irregular calcification within the sella and in the suprasellar region. Routine laboratory tests disclosed no other abnormality.

On right transfrontal craniotomy a large cystic, calcified tumor was found, pushing the optic chiasm forward. A large amount of neoplastic tissue and calcified material was removed. Microscopic examination showed the tumor to be a pituitary adamantinoma.

Except for mild symptoms of diabetes insipidus, which disappeared, convalescence was uneventful. When the patient was dismissed on March 5, 1940, she had a left homonymous hemianopsia with a relative central scotoma in the left eye. Vision was 3/60 in the left eye and 3/30 in the right eye.

The child was brought to the clinic again on March 26, 1941, because of failure of vision which had been noticed for six weeks. She had been taking posterior pituitary by insufflation, and this had controlled her diabetes insipidus. She had gained weight and had grown 1 inch (2.5 cm.) during the year. The visual acuity in her left eye was 3/60 and she could see fingers at 3 feet (91 cm.) with her right eye. Examination of the ocular fundi disclosed pallor, grade 2, of the right disk and papilledema of 2 to 3 diopters of the left optic disk. The visual fields were essentially unchanged. Roentgenograms of the head showed a large calcified tumor extending from the sella turcica upward into the third ventricle.

On re-exploration through the opening made at the time of the right transfrontal craniotomy, a tumor was discovered which appeared much the same as the one removed previously. It was necessary to divide the anterior communicating artery to remove the mass. On microscopic examination it proved to be a pituitary adamantinoma.

Convalescence was uneventful, and when the patient was dismissed on April 16, 1941, she no longer needed insufflations of posterior pituitary. The vision was 2/30 in the left eye and 2/50 in the right eye. The visual fields were unchanged. Four roentgen treatments were given prior to discharge. Two contralateral fields, one in each temporal region, and two frontal fields were used. The factors were: 130 kv., 6 ma., 5 mm. aluminum filter, time nineteen minutes. The tumor dose was about 2,000 r.

A year later, her family physician wrote that the patient was having severe headache again but that there was no change in her visual acuity or visual

fields. Roentgen therapy was advised by us. It was given at home, but details are unavailable. It is known, however, that treatment was followed by improvement and relief of headache. There was no change in the visual acuity or visual fields. The patient improved for about two years and was able to take care of herself until May 1944, when she became bedridden because of a recurrence of symptoms. She died on Dec. 4, 1944.

Comment: Although our information concerning the course of this girl's illness cannot be considered too detailed, since she was not seen at the clinic after her second operation, it is obvious that roentgen therapy relieved her symptoms and may have prolonged her life.

CASE 6: A boy aged 4 years was brought to the clinic on Dec. 30, 1941. Two months previously he had begun to appear lethargic. He had a low-grade fever for several weeks and had slept an excessive amount. He had had several episodes of vomiting, and his parents thought his vision had become impaired. Some polydipsia and polyuria also had been noted during the past two months.

Roentgen examination of the head revealed a calcified suprasellar tumor and some enlargement of the sella turcica. Except for a low-grade fever, the remainder of the examination did not disclose any significant abnormality.

As a therapeutic test, a dose of 24,000 mg. hr. of radium was administered through six fields; over each ear, over each temple, and on either side of the vertex. The factors were: 200 mg. radium, 1.5 mm. Monel metal and 2 mm. lead filter, distance 5 cm., time twenty hours. The patient was dismissed on March 18, 1942.

When the boy was brought back to the clinic on July 27, 1942, his vision was better than it had been when he was last seen and the polyuria was less pronounced. The ocular fundi and visual acuity still were normal. There was no change in the roentgen appearance of the skull, but percussion of the head elicited a cracked-pot sound.

Roentgen therapy was given in three days. Two temporal fields and one frontal field were used. The factors were: 130 kv., 6 ma., 5 mm. aluminum filter, distance 40 cm., time seventeen minutes. The tumor dose was about 800 r.

After the child was taken home (July 30, 1942), he was comparatively well except for occasional episodes of vomiting and a slight fever, which was present constantly. He was brought back to the clinic on Aug. 22, 1943. At that time, roentgen examination disclosed some increase in the size of the tumor. Roentgen therapy again was applied three times. The fields and factors were the same as those previously employed. The patient was dismissed on Aug. 25, 1943.

On return to the clinic for a check-up, on July 8, 1947, examination showed bitemporal hemianoptic scotomas and pallor, grade 1, of the temporal portion of each optic disk. Although the patient was nine years old at this time, he appeared only about six or seven. There was no change in the roentgenographic appearance of the skull.

On July 15, 1947, a right transfrontal craniotomy disclosed a cystic tumor behind the optic chiasm. An intracapsular enucleation was done and the capsule was thoroughly coagulated with electricity. On microscopic examination the tumor proved to be a pituitary adamantinoma.

Convalescence was uneventful. Prior to dismissal, three more roentgen treatments were given, with the same factors and fields.

The patient returned several times during the next two years for re-examination. On one visit, in 1948, he told of having had a generalized convulsive seizure, which had been followed by a transient paresis of the left extremities. On his last visit, in September 1949, he said that there had been no more convulsions. At that time, examination disclosed pallor, grade 1, of the temporal portion of each disk. The bitemporal hemianoptic scotomas were still present, but the cores of the scotomas did not seem as dense as previously. The boy was enjoying normal health and was in the seventh grade in school.

Comment: In this case, there was a definite relationship between the appearance of the optic disks and the duration of the loss of vision. The onset of symptoms occurred only a short time before the patient was first brought to the clinic. At the time of the initial examination the visual acuity and ocular fundi were normal. Even though there was evidence of increased intracranial pressure later in the course of the illness, the ocular fundi remained normal for a considerable time. The patient was asymptomatic for almost four years after roentgen and radium therapy were employed, and operation was not performed until more than six years after the onset of symptoms. A careful microscopic examination of the tissue removed at operation did not disclose any changes which might be attributed to the radiation therapy.

CASE 7: A man aged 45 years registered at the clinic on Dec. 14, 1942. Seventeen months previously, he had first noticed some visual blurring and diplopia. These symptoms had increased progressively in severity. Four months later, he had noted a defect in the temporal field of his right eye. Three

months after this, he had become blind in the left eye. During the five or six months before he came to the clinic, he had suffered from increasingly severe headaches. His right eye turned outward intermittently and his left eyelid drooped at times.

The left eye was found to be blind. Vision was 6/12 in the right eye. Examination disclosed pallor, grade 2, of the left optic disk and pallor, grade 1, of the nasal side of the right optic disk, changes indicative of simple optic atrophy. There was a complete loss of vision in the temporal half of the visual field of the right eye. Roentgen and routine laboratory tests showed no other abnormality.

A right transfrontal craniotomy revealed a cystic tumor situated above the sella turcica and optic chiasm. A radical excision of the tumor was performed. Microscopic examination showed it to be a pituitary adamantinoma. When the patient was dismissed on Jan. 5, 1943, after an uneventful convalescence, the vision was 3/60 in the left eye and 6/12 in the right eye. He had evidence of mild diabetes insipidus and bitemporal hemianopsia.

The patient was able to carry on his usual activities until 1946. In July of that year, he returned to the clinic because of progressive loss of vision over the preceding six months. He had been chronically fatigued for the same length of time and had suffered from severe headache and tinnitus for six weeks. His left eye was blind and vision in the right eye was 6/6. Only the nasal half of the field of vision of the right eye remained. Roentgen examination did not disclose any abnormality.

Re-exploration through the opening previously made by right transfrontal craniotomy revealed a large partially cystic tumor situated in front of and beneath the optic chiasm. The tumor was removed as completely as possible. Microscopic examination showed it to be a pituitary adamantinoma. Convalescence was uneventful, and the patient was dismissed on Aug. 6, with vision and visual fields the same as before the operation.

On Feb. 11, 1947, the patient returned to the clinic because of further loss of vision, tinnitus, slight impairment of memory, and polyuria. He was now found to be blind in both eyes. Examination of the ocular fundi disclosed pallor, grade 2, of the right optic disk and pallor, grade 3, of the left optic disk. The margins of the disks were irregular. Four roentgen treatments were given, through two frontal and two temporal fields. The factors were: 200 kv., 20 ma., 0.75 mm. copper and 1 mm. aluminum filter, distance 50 cm., time twenty minutes. The total tumor dose was about 1,000 r. The patient was dismissed on Feb. 15, 1947.

On return to the clinic, April 21, 1947, another course of four treatments with roentgen rays was given. The factors were the same as those which were used previously, and the total tumor dose was 1,000 r.

On June 28, 1948, the patient was again seen, because of a gastro-intestinal disturbance. His left eye was still blind, but vision in the right eye was 6/7 with correction. Examination of the ocular fundi disclosed pallor, grade 3, of both optic disks. There was a temporal anopsia of the right eye. In addition, a firm annular mass was found in the rectum. On Aug. 25, 1948, a posterior resection was done for an ulcerative perforating mucoid adenocarcinoma, grade 3, with extensive infiltration into the perirectal tissues.

The patient died at his home on March 30, 1949, of metastatic carcinoma.

Comment: In this case, the two courses of roentgen therapy, given seven and nine months, respectively, after the second operation, apparently resulted in a cessation of enlargement of the tumor.

CASE 8: A male aged 19 years registered at the clinic on May 1, 1946, because he had failed to develop sexually. There had been no change of voice and he did not have to shave. He had no axillary or pubic hair and was extremely sensitive to cold. He was stout and blonde, and appeared to be about twelve years of age. The extremities were large and the voice high-pitched. There was a grade 2 gynecomastia, and the genitals were small. Vision was 6/5 in the left eye and 6/20 in the right eye. Examination revealed bitemporal scotomas and slight temporal pallor of both optic disks. Roentgen examination disclosed enlargement, grade 3, of the sella turcica by an intrasellar tumor which had extended to the suprasellar region. The excretion of 17-ketosteroids in the urine was 0.9 mg. in twenty-four hours.

A right transfrontal craniotomy was done and a large cystic tumor was encountered, extending upward into the third ventricle from the sella turcica. Only a portion of the cyst could be removed. It was shown microscopically to be a pituitary adamantinoma. Convalescence was uneventful. When the patient was dismissed on June 12, 1946, there was little change in the ocular findings. He was advised to take 1 grain (0.065 gm.) of thyroid, 30 mg of methyltestosterone, and 5 gm. of salt daily.

On return to the clinic, Sept. 11, 1946, the condition seemed to be improved. The muscle tone was better, the voice was deeper, and scanty pubic hair was appearing. However, there was much further loss of vision, which was now 6/12 in the left eye and 6/60 in the right eye. Examination disclosed pallor, grade 2, of the right optic disk, pallor, grade 1, of the left optic disk, and bitemporal anopsia. The findings on roentgen examination of the head were the same as previously. A course of four treatments with roentgen rays was given, through two temporal and two frontal fields. The factors were: 200 kv., 20 ma., 0.75 mm. copper and 1 mm. aluminum filter, distance 50 cm., time twenty minutes. The total tumor dose was 1,000 r. The patient was dismissed on Sept. 21,

1946. On his return to the clinic, Nov. 20, 1946, he had gained 25 pounds (11.3 kg.). His beard had begun to grow, and his genitalia were definitely larger. Visual acuity had improved, but there was little change in the visual fields or in the ocular fundi.

During the next year, the patient was seen several times at the clinic. A strange discoloration of the nipples developed, and black material could be expressed from them. This unusual development was thought to be due to the methyltestosterone that he was taking. The dose of this preparation was cut in half, and the breast condition subsided.

The patient was last seen in December 1949. At that time, he was feeling well and was able to work a full day. He had not been taking methyltestosterone for about a year, and the beard and pubic hair which had appeared after he had started taking this preparation had disappeared. Examination of the visual fields disclosed temporal anopsia on the left side and an arcuate scotoma on the right side, but their condition was better than at the time of the patient's previous examination at the clinic. Vision was 6/6 in the left eye and 6/20 in the right eye.

Comment: In this case, it is obvious that the pituitary dysfunction had been present for a long time. The apparent improvement manifested by sexual development, growth of hair, and change in the voice could be attributed to the methyltestosterone, especially since the beard and pubic and axillary hair disappeared and sexual development ceased after this preparation was discontinued. The loss of vision was stopped, and vision later improved, apparently as a result of the roentgen therapy.

CASE 9: A man aged 54 years was referred to the clinic on April 12, 1947. He had had no libido for two years. Seven months earlier his vision had begun to be blurred, and gradually the temporal field of vision of his left eye was lost. Roentgen examination showed a possible chiasmal lesion.

The patient had been given twenty treatments with roentgen rays. A total dose of 2,000 r had been administered to each of three fields, two temporal and one frontal. The factors had been as follows: 220 kv., 1 mm. copper filter, distance 50 cm., and a 4 cm. cone. Definite improvement in the visual fields had followed. In January 1947, nine more roentgen treatments had been given for a total of 900 r per field, with the same factors, but there had been no further improvement. One month before the patient was referred to the clinic, he had begun to suffer from severe headache, which had increased progressively in severity.

The visual acuity was 3/60 in the left eye and 6/10 in the right eye. Examination disclosed bitemporal scotomatous hemianopsia and pallor of both optic disks. Roentgen examination showed enlargement of the sella turcica and suprasellar calcification. The excretion of 17-ketosteroids in the urine was 2.7 mg. in twenty-four hours.

On left transfrontal craniotomy a very large cystic tumor with multiple areas of calcification was found. A portion of the tumor was removed before excessive bleeding forced the surgeon to discontinue the operation. Microscopic examination showed pituitary adamantinoma. The patient failed to respond following the operation and died on the first postoperative day.

Comment: According to the case history and information obtained from the family physician, the patient's vision was decidedly improved after the first course of roentgen therapy. The second course had no effect. Careful microscopic examination of the tissue removed at operation failed to disclose any changes which could be attributed to the roentgen irradiation.

CASE 10: A Mexican boy aged 17 years was brought to the clinic on Dec. 8, 1947. Seven years previously, he had had severe headache, diplopia, and vomiting, which had increased progressively in severity. These symptoms had been considered to be due to a pituitary tumor, and in 1941 he had received a total of 4,000 r through two temporal fields aimed at the pituitary body. Other details of the treatment were unobtainable. He had been completely free of any symptoms after this treatment for a period of three years. In 1945, he had had a recurrence of the headache, diplopia, and vomiting, accompanied by polydipsia and progressive loss of vision. Shortly before he was brought to the clinic 14 applications of roentgen rays (6,000 r through five portals) to the pituitary region had failed to produce any relief of the symptoms.

The patient was obese and had immature genitalia, a waxy skin, and gynecomastia. No pubic hair was present. Vision was 6/30 in the left eye and 3/60 in the right eye. There were marked pallor of both optic disks and some loss of substance. Examination of the visual fields disclosed bitemporal hemianopsia. Roentgenographs showed erosion of the floor of the sella turcica and suprasellar calcification. The basal metabolic rate was −28 per cent, and 4.2 mg. of 17-ketosteroids were excreted in the urine in twenty-four hours.

A right transfrontal craniotomy disclosed a large cystic tumor filling the sella turcica and extending back beneath the midbrain. A radical excision of the tumor was performed. It was found on microscopic examination to be a pituitary adamantinoma.

The patient failed to rally after the operation and

died on the third postoperative day in spite of supportive measures.

Comment: According to the history and the information received from the patient's physicians in Mexico, roentgen therapy resulted in a cessation of growth of the tumor, and freedom from symptoms for three years. Microscopic examination of the tissue removed at operation did not reveal any changes which might have resulted from irradiation.

DISCUSSION

Although variable amounts of roentgen radiation were used in these cases, and although in some instances the dose is unknown, it might be well to present in summary the time at which roentgen therapy was employed and the length of the survival period.

In Case 1, the patient received roentgen therapy three weeks and one year after his second operation. He was living and in good health nine years after his initial operation. The second patient received roentgen therapy four months, eight months, and one year, respectively, after operation, and was in good health ten years postoperatively. In the third case, roentgen treatment was used four years after operation and the health was good eight years after operation. Roentgen therapy was given in the fourth case in the immediate postoperative period, and also two months later. The patient was in excellent health more than eight years after her operation. In the fifth case, roentgen therapy followed soon after the second operation and was repeated one year after the operation. Death occurred four and a half years after the first operation.

In the sixth case, radium therapy was used four months and roentgen therapy nine months after the onset of symptoms. The patient was free of symptoms for one year. He then received another course of roentgen therapy, and was asymptomatic for the next four years. At the end of that time he was operated on and another course of roentgen therapy was given postoperatively. He was well and going to school two years after the operation. The seventh patient received roentgen therapy six months and eight months, respectively, after a second operation. He died of a metastatic carcinoma of the bowel six years after his first operation for pituitary adamantinoma. In the eighth case, a course of roentgen therapy was given four months after the operation, and the patient was living and well more than three years later.

In the ninth case, a course of roentgen therapy was given a year and a half after the onset of symptoms. There was a remission of symptoms for three months. A second course of roentgen therapy failed to produce any relief, and the patient died after operation. In Case 10, a course of roentgen therapy was given six months after the onset of the symptoms and the patient was free of symptoms for three years. A second course of roentgen therapy did not produce any relief, and the patient was operated on seven years after the onset of his symptoms. He did not survive the operation.

It is difficult to evaluate the relative merits of roentgen therapy and surgery in the treatment of pituitary adamantinomas, since these tumors frequently are difficult to remove completely. It also seems that they may remain quiescent for a long time. Operation was performed in 96 of the 100 cases of proved pituitary adamantinoma which were observed at the clinic in the years 1916 to 1947, inclusive. In 58 of the 96 cases, the patients survived the operation. In 44 of the 58 cases the operation was performed prior to 1944, and in 41 follow-up data have been obtained for five or more years. Roentgen therapy was also used in 6 of these 41 cases. Five (83.3 per cent) of the 6 patients who received roentgen therapy were alive more than five years after removal of the tumor, while 16 (45.7 per cent) of the 35 patients who did not receive any roentgen therapy were alive five or more years after operation.

We realize that this group of cases is too small to permit any definite conclusions

regarding the relative merits of surgical treatment and roentgen therapy. It appears evident, however, that postoperative irradiation is worth while in cases of pituitary adamantinoma. As is true of all tumors, some pituitary adamantinomas are radiosensitive, while others are radioresistant. It is difficult to explain why microscopic examination does not reveal any effect of irradiation on the tumor in cases in which this type of treatment has obviously produced clinical improvement. As Frazier and his associates (3) have said, roentgen irradiation probably inhibits the formation of cystic fluid by destroying the secretory power of the tumor cells.

SUMMARY

This report is based on 10 cases of pituitary adamantinoma in which remission or improvement of symptoms could be attributed to roentgen therapy. In the cases in which irradiation was used at various times after operation the improvement was definitely greater than that obtained in cases in which the patients were treated by surgical measures alone. In 3 cases in which roentgen therapy was given before operation, microscopic examination of the surgical specimen did not disclose any change attributable to the radiation.

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SUMARIO

Roentgenoterapia de los Adamantinomas Pituitarios (Craneofaringiomas)

En una serie de 100 adamantinomas hipofisarios, comprobados microscópicamente, que fueron observados en la Clínica Mayo en un período de treinta y dos años, la roentgenoterapia fué empleada en 15. En 2, en que se usó poco después de la operación, los enfermos estuvieron asintomáticos por un año, pero no hay modo de determinar qué papel desempeñó la irradiación en el alivio de los síntomas. La roentgenoterapia no ejerció aparentemente el menor efecto en 2 casos, y no hay datos disponsibles para el resultado en otro caso.

Esta comunicación se basa en los 10 casos restantes, en los cuales puede imputarse a la radioterapia la remisión o mejoría de los síntomas. En los casos en los que se usó la roentgenoterapia en varias ocasiones después de la operación, la mejoría fué decididamente mayor que la obtenida en otros en los que los infermos fueron tratados exclusivamente con providencias quirúrgicas. En 3 casos en los que se utilizó la roentgenoterapia antes de la operación, el examen microscópico del ejemplar quirúrgico no reveló la menor alteración imputable a la roentgenoterapia.

Preliminary Clinical Experience with the Betatron[1]

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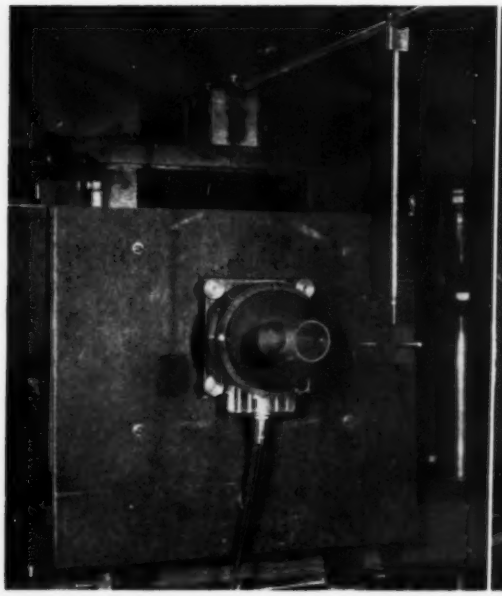
THE BETATRON is primarily a physics research tool and industrial x-ray machine. We are exploring its medical possibilities and realize that it will be a long-term project. The present report high-lights some of our progress, some of the general idea of speeding electrons in a magnetic field was recognized as feasible. Since that time many university and industrial groups have tackled the problem, and in 1940 Kerst (1) succeeded in accelerating and guiding electrons into a



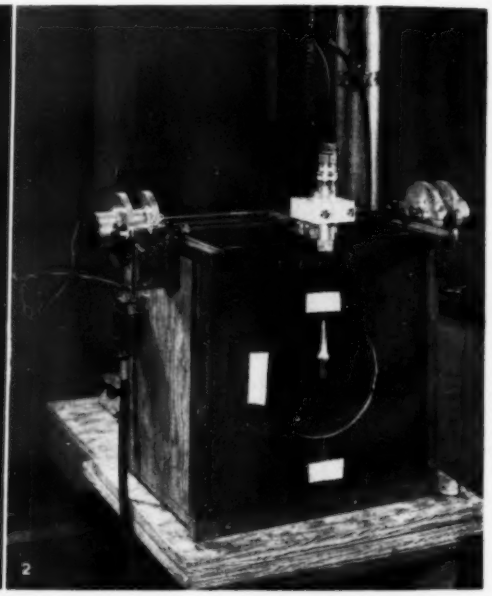


Fig. 1. Front of the magnet with protective barriers, beam collimators, ionization chambers, and entrance and exit beam localizers in place.

Fig. 2. Water phantom with ionization chamber shown in window area. Selsyn motors change location of ionization chambers as desired, from control panel in adjacent room.

(*Figs. 1 and 2 appearing also in American Journal of Roentgenology*)

the obstacles encountered, and some of the early biological effects we have observed.

As its name implies, the betatron is an agency for producing high-energy electrons, *i.e.*, beta particles. The desirability of great acceleration of electrons and the limitations of ordinary transformers for this purpose were recognized many years ago. As far back as 1922 useful beam of x-rays. At present we are converting these high-speed electrons into extremely powerful x-rays but, as Uhlmann and Skaggs (2) have shown, electrons can be brought out as a separate beam for future investigation.

The betatron differs from other accelerators in that it is quite compact, gives continuous acceleration to the par-

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[1] From the Department of Radiology of the University of Illinois College of Medicine, and Research and Educational Hospital, Chicago, Ill. Presented at the James Ewing Society, Memorial Hospital, New York, N. Y., March 18, 1950. Accepted for publication in September 1950.

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ticles, and uses only light particles. In contrast, any accelerator involving the cyclotron principle gives an intermittent or discontinuous type of push to the particle. Several of the larger types of accelerators are better at moving heavy particles than electrons.

The first problem one faces in housing a betatron is the protection of operating personnel and neighbors from harmful radiations. In our installation, personnel are protected by a wall of 30 inches of concrete and 4 inches of lead separating the treatment magnet from the control rack. This wall runs parallel to the main axis of the beam and keeps the radiation level below 0.3 r per week (forty-hour operating time) in the control and preparation room. Our neighbors are protected by concrete walls and the underground direction of our beam. The problem of protecting animals or patients in front of the treatment magnet from scattered electrons, scattered x-rays, and neutrons is not so easily solved. Scattered electrons are reduced by interposing blocks of lucite; scattered x-rays are reduced by the heavy laminated lead collimator through which the useful beam passes, and by a massive external lead panel (Fig. 1). The neutrons are more difficult to reduce; at present, we are eliminating all possible sources of the gamma-n reaction in the path of the main x-ray beam.

The determination of quantity of radiation at any given point is not easy, because of the long forward travel of the scattered rays and the behavior of ionization devices at high-energy levels. The rather limited amount of ionization occurring in air prevents us from adhering to the strictest detail of the definition of the roentgen. Instead, we resort to measurements in water phantoms (Fig. 2) and large lucite blocks where the intensity of ionization more nearly duplicates that in tissues. We are using thick-walled Victoreen chambers, locally designed and constructed ionization devices, and film density methods. Our output will vary from one tube to another and with different set-ups.

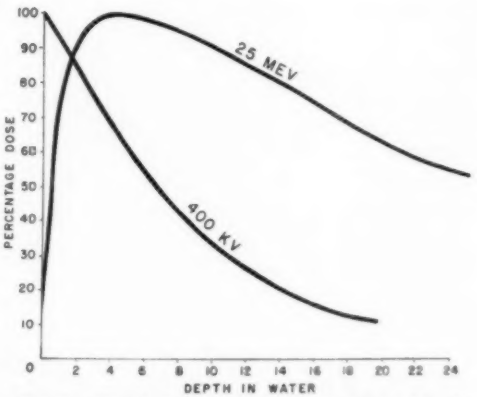


Fig. 3. Depth dose curve in a phantom with the Betatron operated at 25 mev. A curve for the 400,000-volt therapy unit is shown for comparison.

We have recordings as high as 160 r per minute at 80 cm. from the target, and as low as 40 r per minute. At present our patients receive 60 r/min. with a 15 cm. port, 70 r/min. with a 10 cm. port, and 100 r/min. with a 5 cm. port.

The quality of radiation produced by the betatron is not accurately expressed in commonly known standards of half-value layer expressions. All of our quantitative measurements show that our peak dose (100 per cent) at 23 mev. is 4.5 cm. deep in the tissues (Fig. 3). The skin surface dose measures only 8 per cent, *i.e.*, only 8 per cent of the maximum amount measured deeper (4.5 cm.) in the tissue. Qualitative expressions are therefore made in terms of the depth of the 100 per cent level in phantoms or tissue. This 100 per cent level can be moved nearer to the surface by lowering the voltage, or moved deeper by increasing the voltage. Much higher voltage than we are using does not seem practical for the production of x-rays, because of the attending significant elevation in the slope of the exit dose. The uniformity of quantity of radiations at any given depth is shown in the isodose chart reproduced in Figure 4.

Our investigations of biological effects of the betatron have been greatly aided by the early work of Quastler and his associates (3–5). Their work on *Drosophila*

eggs, graying of mouse hair, and mouse survival times indicated that the roentgen measured in the betatron x-ray beam was in the vicinity of 70 to 75 per cent as effective biologically as the roentgen from conventional x-ray apparatus. Our initial biological tests involved chiefly small animals and included mainly detailed studies on skin, blood, bone, cartilage, and brain tissues. All of our work has been confirmed by observations on unirradiated animals as well as comparative parallel experiments using 200-kv. and 400-kv. x-rays. The latter studies have been fruitful, even though repetitious of previous work by others, in that we have observed occasional changes with smaller doses than generally accepted. We are in the process of analyzing data collected over the last year, and it is too early to quote our results. Our human tests, however, were started on the basis of Quastler's figure of 70 to 75 per cent effectiveness, and our own early work, which roughly substantiated his. As we have gone on, we have revised this figure downward and consequently have given successive groups of patients larger and larger doses. Our animal work suggests the effectiveness at a maximum of 65 per cent. We are now looking for variations in effectiveness among different tissues. This does not mean that the betatron is any less useful; merely that the doses given will sound alarming to those who fail to consider the differences in relative effectiveness.

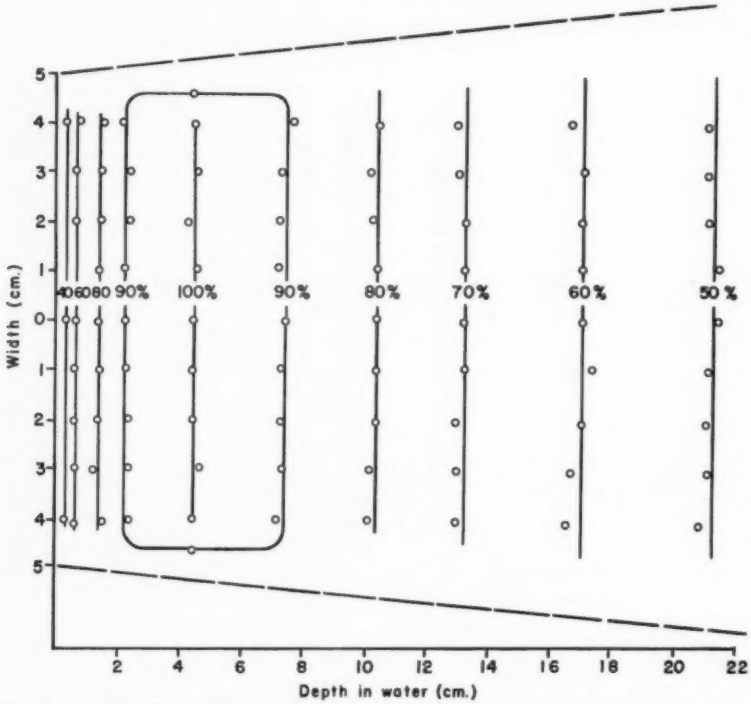


Fig. 4. Isodose chart made from the phantom with the betatron x-ray beam entering from the left. Reproduced by courtesy of Science (111: 514-516, May 12, 1950).

The choice of patients for the first tests with the betatron was not based so much on the depth dose advantages of the betatron as on our desire for lesions which we could observe from day to day during treatment. The patients available to us at that time had primary neoplasms of the mouth, pharynx, and larynx. By using indirect portals of entry of the beam we were able to interpose enough tissue be-

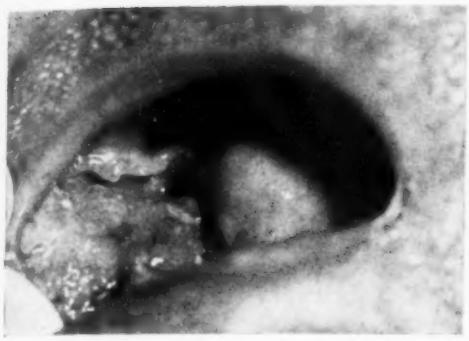


Fig. 5. Extensive carcinoma of the lower alveolar ridge.

tween the skin and tumor to make up the 4.0 to 4.5 cm. desired depth. This group completed treatment in October 1949.

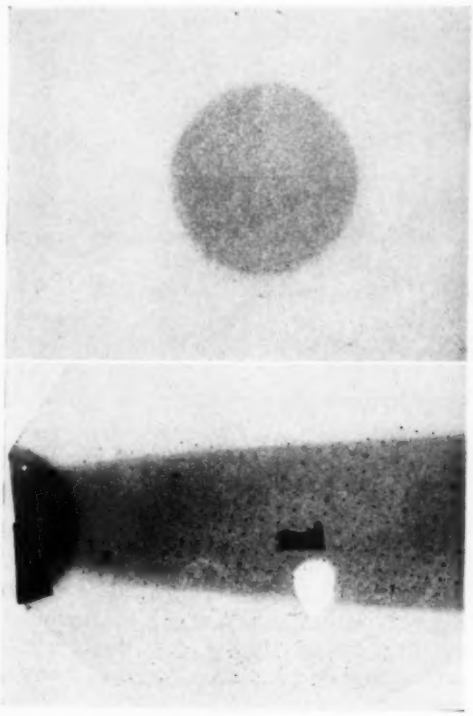
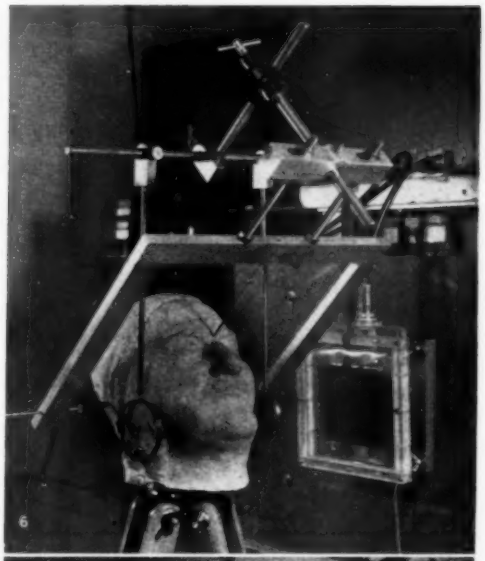


Fig. 8. Developed films from the masonite head. The circular dense area in the upper view represents the beam directed at the reader. The lower view shows the beam path at right angles to the first. On the left is an area of overlapping density from cross-fire. Ink dots are related to densitometry readings, and the ragged clear area to a peg running through the laminations. Note the lack of scattering outside the main beam path.



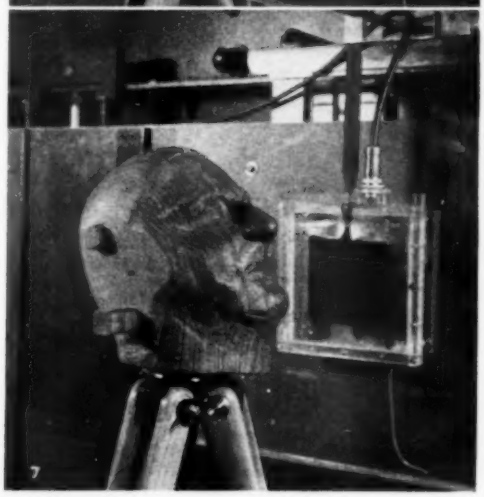


Fig. 6. Plaster-of-paris form used for predetermining patient position for treatment. Localizing points for anatomical landmarks and rings for beam path are the important features.

Fig. 7. Laminated masonite head which has been substituted for the plaster-of-Paris head. It is in position for a treatment.

There were several hundred applicants for treatment by the time we were ready to select patients for our second group. Many of these were so near terminal status that they did not live to receive even a prompt answer to their inquiry; others had tumors so widespread that no form of radiation therapy could give more than

slight palliation. Had we taken applications as received, or even on the basis of pressure, we would very likely have no living patients to discuss at this time. Perhaps we should point out that all of our patients must be ambulatory, since we lack beds, and all come from our Tumor Clinic, which is governed largely by rules of charity status and Illinois residence since we operate under Illinois taxes. We doubt that these limitations have denied anyone the chance of cure up to this time.

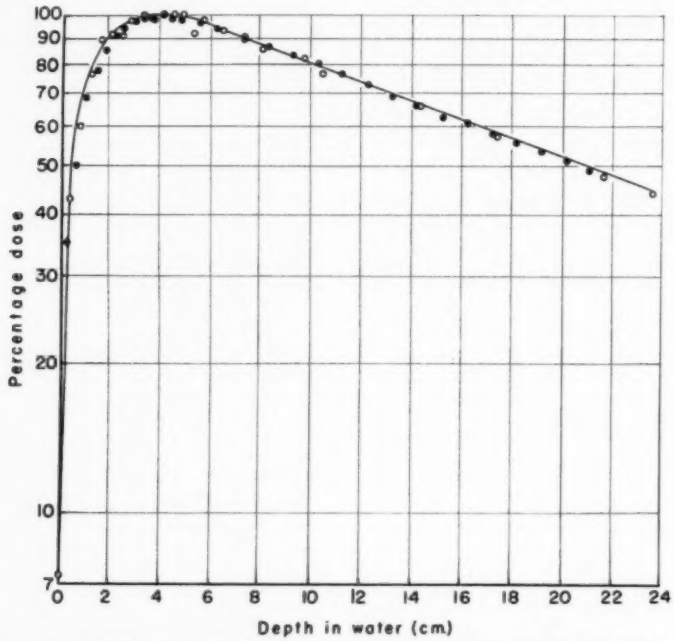


Fig. 9. Showing close correlation between ionization measurements in the masonite head (•) and film density measurements between the laminations (◦). Reproduced by courtesy of Science (111: 514–516, May 12, 1950).

The second group of patients had neoplasms of the palate, bladder, cervix, pituitary, and lung. Treatment was completed in January 1950.

The third group adds neoplasms of the brain and base of tongue to our experience, which now totals 17 patients. The last group has been the most calamitous. One of the elderly bladder patients succumbed about one-third of the way through his treatments from a heart attack. Autopsy material is now being processed and will be of great value, since we have samples of tissues throughout the path of the beam. All of the other patients are alive, all subjectively improved, and the majority objectively improved. Except for 2 patients, all had far advanced, inoperable, hopeless cancer and were further afflicted with serious heart disease, diabetes, or the infirmities of advanced age.

A brief description of the preparation and observations on one of our early patients may give a better idea of the way the clinical application has been conducted.

A 69-year-old cardiac patient had extensive epidermoid carcinoma of the alveolar ridge (Fig. 5). X-ray films revealed 50 per cent destruction of the mandible in the underlying area. Blood counts were normal. A plaster-of-Paris cast was made of the patient's head (Fig. 6), and was used for beam alignment through the several different ports used. A laminated masonite copy of this cast (Fig. 7) was also made, and x-ray films were placed between the laminations. A short treatment was given to this head and sub-

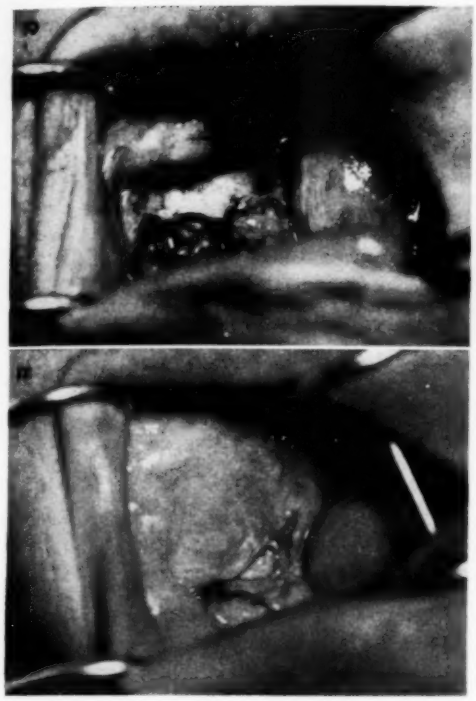


Fig. 10. Massive destruction of tumor and exposure of the mandible after half of the treatment. Same case as Fig. 5.

Fig. 11. Degree of spontaneous healing two months after treatment. Biopsy still shows residual cancer. Same case as Figs. 5 and 10.

sequently processed films showed the direction and coverage by the beam (Fig. 8). The lack of scattered radiation is obvious and the uniformity of blackening of the film is strikingly brought out on photoelectric densitometry readings (Fig. 9). The treatment totaled 7,600 betatron r to the tumor in divided doses over an objectionably long period of two months. Some of this delay in completing treatment was due to the small cautious dosage used initially, mechanical difficulties, and the poor condition of the patient. There was rapid and massive disintegration of the tumor, as shown in Figure 10, after three weeks of treatment. Two months after treatment regression had reached the point shown in Figure 11, although tumor was still present. The mandible maintained a *status quo* for three months and then fractured at the angle, from exactly what cause is not yet obvious. Skin reaction at its maximum was negligible (Fig. 12), loss of beard in the path of the beam being most noticeable.

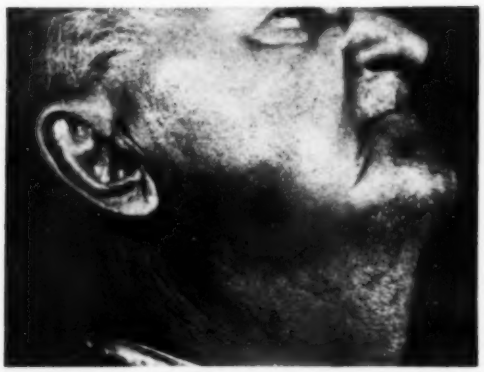


Fig. 12. Skin reaction in patient shown in Figs. 5, 10, and 11, at its height. Erythema was slight. Epilation is prominent in the path of the beams directed from front to back and from the side.

The second group included a 55-year-old patient with severe diabetes, severe coronary thrombotic episodes, and adenocarcinoma of the palate (Fig. 13). He received a tumor dose of 7,900 betatron r to the tumor in a period of five weeks. The lesion continues to regress, and eating and swallowing functions have improved markedly. Interestingly, this patient has shown partial epilation in the occipital area (Fig. 14) resulting from two treatments directed from the front and two from the back with a calculated local dose of 600 betatron r. In all, nine ports were used, indicating our interest in rotational therapy although we do not choose to complicate our evaluation by introducing another possible factor at this time.

The pituitary tumors have been of the chromophobe adenoma type, partially removed by surgery in some cases, with typical ballooning of the sella turcica and with visual disturbances. They received 5,000 betatron r in twenty-five days and 5,700 betatron r in eighteen days respectively, both *via* nine ports. It is still too early to analyze visual trends, but

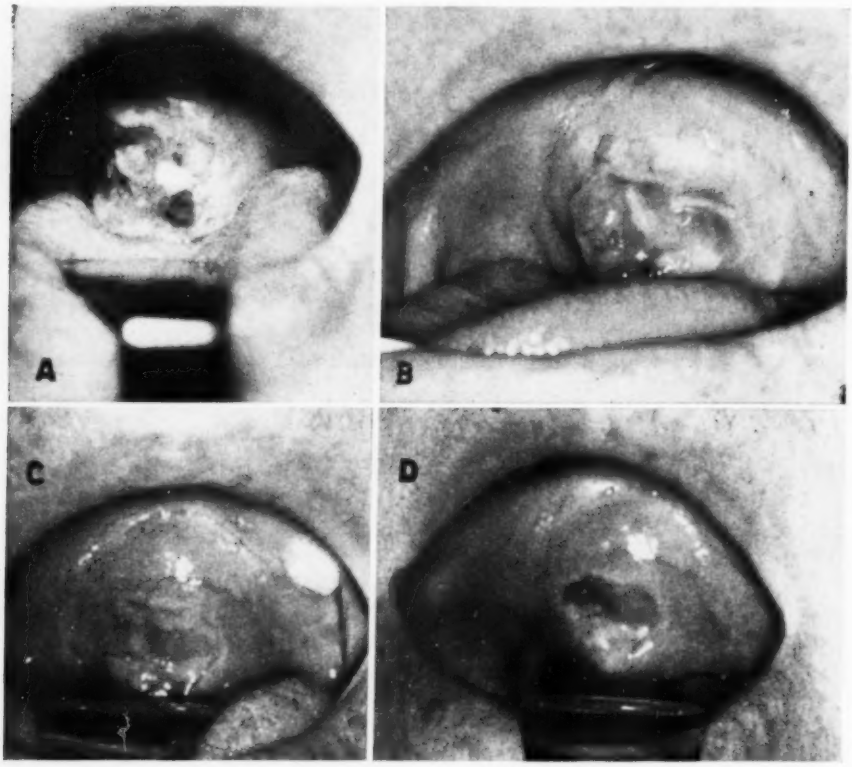


Fig. 13. Group of intra-oral photographs of an adenocarcinoma of the palate. A. Before treatment. B. After 2,400 betatron r. C. After 7,900 betatron r. D. Two weeks after treatment ended. Regression continues.

the numerous other complaints and disturbances subsided early in the treatment period.

The first lung cancer patients had lobe atelectasis, and the recent group included a superior sulcus tumor. The earlier patients received 6,500 betatron r into the tumor in five weeks time, and the recent one 9,000 betatron r in an equal period. In all pain and cough decreased as the treatment progressed.

The elderly patients with bladder lesions have received a tumor dose of 6,400 betatron r. During treatment hematuria ceased. Minimal diarrhea occurred in the course of irradiation but this stopped at the end of the treatment period. Some burning sensations were experienced in the bladder during and for several days after treatment. Cystoscopically marked necrosis of tumor was evident, with surprisingly little reaction in normal tissues.

A 53-year-old patient with a Group IV cancer of the cervix received 5,300 betatron r to the tumor in five weeks. She is the only patient so far to complain of radiation nausea and significant diarrhea. Both complaints were controlled by reducing the daily dose of radiation or by decreasing the port size. This patient has shown an excellent distribution of reaction in the tumor zone and is free from complaints. Grossly her tumor has shown no progression; regression is questionable at this early date. We plan to use radium as soon as we can convince ourselves that regression is or is not going to start from the betatron treatment.

More recently we have been using papier mâché forms of the areas to be treated

rather than plaster-of-Paris and laminated masonite reproductions. With these forms we predetermine the direction of the beam in the patient, the number of ports to be used, the relation of portals of entry and exit, and the plotting of isodose curves. Since the forms are hinged, they can be easily applied to the patient for proper positioning and removed for the actual treatment. Figure 15 shows a representative group of these forms, for pituitary, cervix, and bronchogenic neoplasm patients.

One final case may be cited. This is an example of a late radiation skin condition following conventional x-ray therapy. The patient was treated with 400-kv. x-rays in 1943–44 for a sarcoma of the cerebellum, receiving a total air dose of 10,600 r to three occipital ports. An additional dose of 1,600 r of 400-kv. x-rays was given in 1949 for recurrent symptoms. This case is typical of many that are referred for betatron therapy after they have had the limit—or more—of conventional x-ray therapy. If atrophy of the brain is not already present in this instance, chance of its developing after some betatron x-ray is certainly likely. We know that conventional x-ray therapy can produce atrophy, and betatron therapy may be

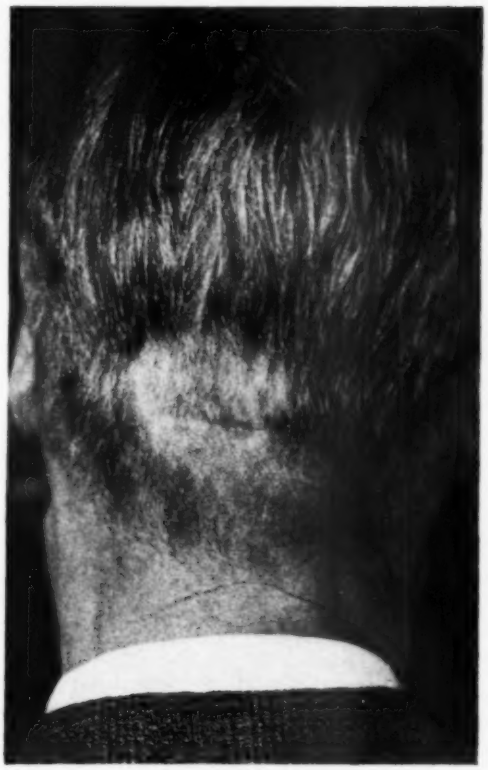


Fig. 14. Same patient as in Fig. 13. Occipital epilation is partial and resulted from overlapping of the exit beam from two treatments directed from the anterior aspect and the entrance dose from two treatments directed from the posterior aspect of the head.

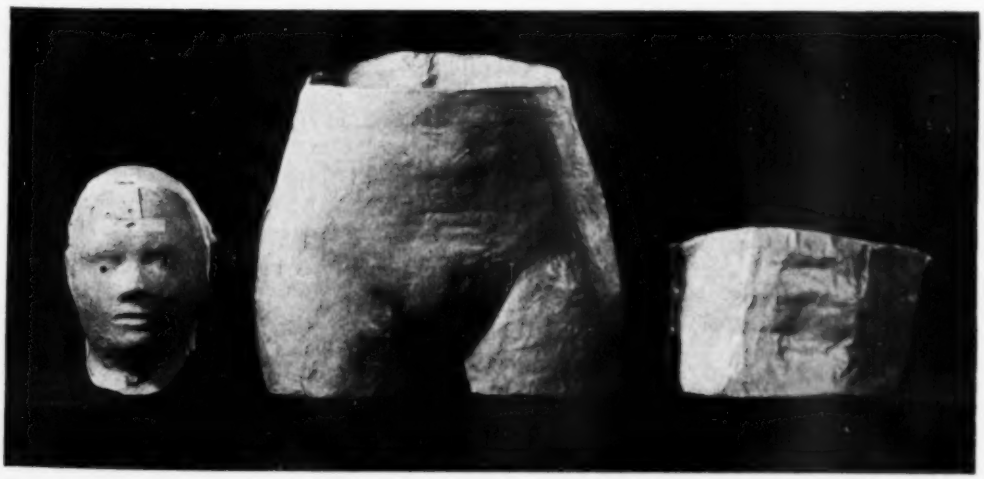


Fig. 15. Group of papier mâché forms from various patients. These are used for predetermining the site and number of entrance ports, relation of entrance and exit ports, and for isodose plotting.

limited more by deep atrophic changes than by skin changes.

CONCLUSION

It is impossible to draw any dramatic conclusions from this study. We think it is obvious that the betatron has some deleterious action on certain types of neoplasms, that the depth dose distribution is an advantage for treatment of deep-seated lesions, and that the skin reactions are minimal. We are revising the predictions and interpretation of early biological effects downward and raising the total dosage levels correspondingly in our clinical work. We are aiming for complete courses of treatment in a period of four to five weeks, with single daily doses of about 400 betatron r, and totals of at least 5,700 betatron r for pituitary tumors and at least 9,000 betatron r for malignant tumors elsewhere.

It will take a long time to evaluate fully the influence of the betatron on cancer therapy statistics. More betatrons are needed, but in view of their hazards and need for special personnel they should be limited to large cancer treatment centers until more is known about what they can do.

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SUMARIO

Observaciones Clínicas Preliminares con el Betatrón

El betatrón es un mecanismo destinado a producir electrones de alta energía que pueden convertirse en rayos X sumamente poderosos. Discrepa de otros aparatos, como el ciclotrón, destinados a la aceleración de electrones, en ser muy compacto y suministrar aceleración continua más bien que intermitente.

Mediciones cuantitativas han revelado que la dosis tope de 23 millones de voltios-electrones es a 4.5 cm. dentro de los tejidos. La dosis piel sólo representa 8 por ciento de dicha dosis máxima.

El roentgen medido en el haz de rayos X del betatrón ha mostrado aproximadamente no más de 70 a 75 por ciento de la eficacia biológica del roentgen convencional, y las observaciones de los AA. les hacen creer que la efectividad puede ser aun menor.

Al presentar una comunicación preliminar sobre la aplicación clínica de la irradiación con el betatrón en 17 casos, dedúcese que la última ejerce algún efecto nocivo sobre ciertas formas de neoplasmas, que la distribución profunda de la dosis constituye una ventaja en el tratamiento de lesiones hondas y que las reacciones cutáneas son mínimas. Los AA. tratan de administrar completas series terapéuticas en un período de cuatro o cinco semanas con dosis diarias únicas de unos 400 r betatrón y totales mínimos de 5,700 r betatrón para los tumores hipofisarios y de 9,000 r betatrón para los tumores malignos de otras regiones.

Problems of Clinical Radiobiology[1]

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AS INDICATED by the title, it is the object of this paper to give insight into some of the tasks which are to be taken up in radiobiological research at a radiotherapeutic cancer center. Since problems and not results are to be discussed, the lecture should only throw light on a field previously unheeded and on some of the means by which it may be attacked.

Neither chemotherapy nor internal radiotherapy (with radioisotopes) has proved of such effect in cancer treatment as to justify the disregard of any possibility of pushing the rational utilization of classical x-ray and radium therapy a step further.

In the present state of radiotherapy, involving large total doses which must pass through considerable volumes of tissue, the necessity of paying due regard to the stress on the irradiated organism should be more evident than before. Outstanding examples are Coutard therapy of tumors in the upper parts of the respiratory and digestive tracts, rotation treatment of cancer of the esophagus, and radium and x-ray irradiation of cancer of the uterine cervix.

In irradiation of moderate or large amounts of tissue, the limit of the total dose is set by the tolerance of the organism as a whole. In irradiation of small amounts of tissue only, the local reactions of the skin and of the sensitive tissues are the limiting factors.

As early as the twenties Coutard felt the want of a "physiological" radiotherapy, making proper allowance for changes in the functions of the irradiated organism. The interest in a physiological view of the problems of radiotherapy has, however, been slight. Nevertheless, radiotherapy has not been uninfluenced by surgery, in which field the adoption of physiological principles has opened up new roads to success.

THE TASK OF CLINICAL RADIOBIOLOGY

The response of the organism to a known amount of radiation can be measured only in a quantitative radiobiological experiment. Thus the task is divided into two parts, the physical and the biological dose problems.

Since the integral dose of Mayneord is a useful measure of the total radiation energy absorbed, there is no necessity for discussing further the physical dose problem. The biological dose problem is more difficult, since the systemic reaction of the organism represents a change in the general health condition. The general condition is a clinical concept the physiological elements of which are difficult to grasp without special means. Therefore, a changed view of the mechanism of biological effects of radiation, as well as a new discipline founded on that view, is required.

The main task of clinical radiobiology, therefore, should be the transference of the quantitative radiobiological experiment to the clinic, so that measurements can be performed on every patient before, during, and after treatment. Only by such measurements will it be possible to adapt the treatment to the biological variability of which the radiation tolerance of man, even in health, is an outstanding example. To be brief, in the solution of everyday problems, clinical radiobiology has to make use of routine methods. Uncritical acceptance of the procedures of the customary clinical laboratory can be ex-

[1] From the Radium Center of Copenhagen (Physician in Chief, Jens Nielsen, M.D.). A lecture delivered before the Danish Radiological Society at its 227th ordinary meeting, Copenhagen, May 10, 1950. Accepted for publication in June 1950.

cluded, however, since the methods of clinical radiobiology are being developed and modified by the research they are serving.

A HOMEOSTATIC CONCEPT OF RADIATION TOLERANCE

Whether partial- or total-body exposure takes place, the systemic reaction of the organism shows that it responds collectively, not as a population of independent biological units. Whenever the spotlight of radiobiological research moves from objects of lower to objects of higher organizational level, this biological fact is met with—from cells to tissues, from tissues to organs, and so on. Therefore, if we are to succeed in unifying the separate spheres of experience of general radiobiology and of special radiobiology, this fundamental fact must be explained. This should be done by a working hypothesis which can be tested experimentally.

Even with a more thorough knowledge of the nature of the direct and indirect effects of radiation than we have today, it will be necessary to use a heuristic principle.[2] According to the principle of Claude Bernard,[3] which apparently involves the fundamental idea of experimental medicine, the organism is a closely knit community, the innumerable components of which are organized to keep the internal environment constant in the face of fluctuating external conditions of life. Thus, body temperature, blood pressure, pulse rate, etc., are physiological constants.

Designating this tendency to maintain a "steady state" by the word homeostasis, coined by Cannon (from the Greek, *homeo*, similar, and *stasis*, stand-still), we are able to speak of the homeostatic regulation of any physiological function. In consideration of the body reserves maintaining constant a physiological function, it will be logical also to speak of the capacity for homeostatic regulation of the function in question.

Since the final result of severe stress must be a disturbance of the internal environment to the point of impairment of normal cellular function, *the individual radiation tolerance of man may probably be expressed by his capacity for homeostatic regulation of oxygen transport.* In this way, the functions of bone marrow —the object of previous one-sided interest—are brought into coherence with other mechanisms taking part in the homeostasis of oxygen transport. The assumption of a critical tissue as the ultimate cause of radiation death seems improbable. In the case of severe injury by radiation, even return of erythropoiesis cannot be considered an absolute criterion of survival of the organism.

ANALYSIS OF THE RADIATION SYNDROME

The necessity for an integrating concept of the dynamics of radiation injury is emphasized further by clinical experience. Both acute and chronic radiation illness are states involving the entire organism and characterized by a general impairment of the circulation. In numerous patients undergoing x-ray treatment Coutard and Lavedan (1922) observed symptoms such as: adynamia, dyspnea, tachycardia, and a falling blood pressure, all of which are indicative of an acute overloading of the organism. In light cases the phenomena disappeared within a few weeks; in severe cases recovery was protracted and death not infrequently resulted.

While the acute radiation syndrome is a fulminant shock-like condition, the failure of circulation in the chronic radiation syndrome is a protracted one due to aplastic anemia. Intense radiation injury in atomic war, followed by death within hours or days, and "thorotrast" poisoning following angiography, with survival for

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[2] A heuristic principle (from the Greek, *(h)eurisko*, I find) is defined as a principle which is useful in the detection of new laws and facts. Such principles are indeed used in all branches of science, *e.g.*, the theorem of Le Chatelier in chemistry, the principle of least action in physics, the calculus of variation in mathematics, and Claude Bernard's constancy of internal environment in biology.

[3] "All vital mechanisms, however varied they may be, have only one object, that of preserving constant the conditions of life in the internal environment."

several years, are examples of these extremes. Since the mechanisms contributing to the regulation of oxygen transport are in part slowly and in part rapidly acting, the clinical picture of the radiation syndrome depends both on the intensity and on the duration of stress, as well as on the efficiency of homeostasis. After repeated sublethal stress, the organism does not return to the original condition. This phenomenon may be termed hysteresis in view of its physical analogy. In fact, the organism responds to repeated stress caused by small integral doses of radiation with an adaptation. This may explain why the radiation intoxication (German, *Röntgenkater*) previously encountered so frequently has almost disappeared in our epoch of the refined therapy of Coutard. However, the relationship of the "general adaptation syndrome" of Selye to radiation illness has not been clarified. Since the direct action of ionizing radiation on living matter—like the action of radiomimetic chemical agents—is an attack on chromosomes, we might speak of a generalized cell damage incomparable to other forms of injury.

To use a hackneyed analogy—that the strength of a chain depends upon the strength of its weakest link—the growing knowledge of the physiology of the mechanisms taking part in the homeostasis of oxygen transport may be interpreted as an extending knowledge of ways in which this homeostasis may be broken by various forms of injury to the organism.

In pathological states threatening the homeostasis of oxygen transport, the handicap of the organism may reach such an extent that increased demands for oxygen transport can be fulfilled only with difficulty, or not at all. In anemia, the oxygen transport capacity of the blood is lowered; in case of an excessive basal metabolic rate, the demand for oxygen transport is increased beforehand; an undernourished and dehydrated person exhibits a smaller blood volume than normal; heart disease may cause a lowering of the cardiac output per minute, etc.

In short, if the capacity of the homeostatic regulation of oxygen transport be considered an adequate measure of the individual radiation tolerance, this novel view should make possible a diversified realization of dependence of the radiation tolerance on the condition of the organism. Of measurable quantities presumed to be of importance in the evaluation of the radiation tolerance of man, the physical working capacity might be the most direct expression of the capacity of the oxygen transport system. This concept, however, needs support from other measurements, for theoretical as well as practical reasons.

THE LIMITATION OF RADIATION TOLERANCE BY ANEMIA

Since the ultimate result of severe stress must be anoxia of varying degree, several problems of clinical importance to cancer patients, both treated and untreated, are closely related to the total hemoglobin and the blood volume, *e.g.*, (*a*) the fundamental disturbance of hemoglobin formation in the organism of the cancer patient; (*b*) the share of the erythrolytic action of ionizing radiations and their depression of erythropoiesis in "radiation anemia"; (*c*) the variation of blood volume as a possible measure of stress on the irradiated organism.

The blood depletion of the cancer-sick organism, though observed many years ago (Louis, 1846), has not yet been fully recognized. Experience, however, has shown severe anemia to be a contraindication to radiotherapy. This knowledge has brought about more frequent use of blood transfusions for patients undergoing treatment.

The hemoglobin percentage, since it defines only the concentration of hemoglobin (erythrocytes) in plasma, is as a rule an unreliable index of hemoglobin deficiency. In anemias of gradual onset, there is a tendency to maintain a constant total volume of blood, the loss of erythrocytes being compensated for by an increase of plasma. Therefore, the volume

being comparatively constant, measurements of the quantity of hemoglobin or cells in a unit volume of blood may serve as a rough index of their total quantity. Exceptions to this rule occur often in cancer. In the dehydrated patient with cancer of the esophagus, for example, a greater deficiency of plasma than erythrocytes occurs, the degree of anemia being thus masked. The reverse obtains in the hydremic leukemic patient. For clinical and theoretical reasons, the relative (or absolute) hemoglobin percentage must be supplemented by a total hemoglobin determination.

Using a dye-dilution method, Forfota and Karady (1937) were able to demonstrate lowering of the circulating blood volume in acute radiation poisoning of dogs. Strange to say, no papers on the use of blood volume determinations in investigations of irradiation symptoms in man have been found in the literature. Heim (1923), however, emphasized that the variation of hemoglobin percentage in the course of x-ray treatment was a useful measure of the response of the organism. This was denied by E. Rud (1925), who investigated the blood of radium-treated patients with cancer of the uterine cervix. Let it be added that it is by no means certain that a quantitative correlation exists between the radiation stress and the variation of blood volume with time as an indicator of the homeostatic response of the oxygen transport mechanism. It must be one task of clinical radiobiology to clarify this matter by statistical analysis of quantitative data. Further, it might in this way be possible to discern whether or not a patient responds in an appropriate manner to irradiation.

Since the practical purpose of clinical radiobiology is to carry out measurements on every patient before, during, and after treatment, the known methods of blood volume determination have been reviewed with regard to their clinical application and routine performance without significant loss of exactness. A series of experiments with different methods has been performed. It may suffice to say that only the carbon monoxide method of Torgny Sjöstrand, which is very exact and rapid, has proved useful.

Sjöstrand's Carbon Monoxide Method: The apparatus used for obtaining samples of alveolar air is a closed respiration system connected to the patient by a respiration valve with a mouthpiece. It consists of an oxygen container and two 7-liter rubber bags which can be connected alternately to the system by means of a special stopcock. The carbon dioxide filter is placed in the return tube. The system can be closed with a three-way stopcock. When opened to the atmosphere, the latter permits flushing of lungs and apparatus with oxygen before the measurement proper takes place. With a Record syringe sealed with paraffin oil, a small amount of carbon monoxide (about 15 ml.) is injected into the system. Samples of alveolar air are analyzed in the carbon monoxide indicator of Lindeløv and Sjöstrand, where the catalytic combustion of carbon monoxide at room temperature is registered with a differential thermometer. In duplicate determinations an accuracy of 3 per cent is secured.

ENZYMATIC ACTIVITIES AS INDICATORS OF THE HOMEOSTATIC RESPONSE

To the previous remarks on the study of the general health condition of radiotherapy patients a few words may be added. Since it has been proved by experiments that a greater dose of radiation is required to kill cancer cells *in vitro* than *in vivo*, and, by clinical experience, that the radioresistance of tumors increases in cachexia, the influence of the general health condition on the symptomatic result of radiotherapy cannot be doubted.

Considering that enzymatic activities probably play a prominent role in the homeostatic response of the organism and may be valuable indicators of shifts from one phase of the response to another, it might next be useful to follow the behavior of the tumor by means of West-Hilliard's test, which is based upon the presence in the blood of inhibitors of proteolytic enzymes. Furthermore, enzymatic studies on blood may furnish surer criteria of radiation injury than the customary morphological blood examinations. Thus, the

choline esterase content of the erythrocytes might be a measure of erythropoiesis. The problem of the liberation of enzymes from injured cells has been referred to in preliminary studies (Johansen and Thygesen).

SUMMARY

An altered view of the mechanism of the biological effects of ionizing radiation has led to investigations of problems that have hitherto received little attention. In this way a new field—clinical radiobiology—has been opened up. Clinical radiobiology endeavors to fulfill the need of a physiological approach to the problems facing the radiotherapist.

In the curative radiotherapy of cancer, where the radiation must often pass through considerable volumes of tissue, the limit of the total dose is set by the tolerance of the organism as a whole. The systemic response of the organism must be checked by measurements on every patient before, during, and after treatment.

The radiation tolerance of an individual is defined as his capacity for homeostatic regulation of oxygen transport.

Since the ultimate result of severe stress must be anoxia, several problems of clinical importance are closely related to the total hemoglobin and blood volume. For determining the blood volume, Sjöstrand's carbon monoxide method is both exact and rapid.

NOTE: The blood volume apparatus (a product of AB. Koloxidindikator, Stockholm) was a gift from AB. Stockholms Kylhus. Accessories were given by A/S Det Danske Kølehus, "Cold Stores," Copenhagen. Associate Professor Torgny Sjöstrand, M.D., of Karolinska Sjukhuset, Stockholm, placed his practical experience and theoretical knowledge of the problems involved at the author's disposal, beautifully exemplifying the interscandinavian spirit. The Danish Cancer League furnished various facilities. To all these the author and the Radium Center express their gratitude.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Problemas de la Radiobiología Clínica

Una opinión modificada del mecanismo de los efectos biológicos de la irradiación yonizante ha hecho investigar problemas que habían recibido poca atención hasta ahora. De este modo ha surgido una nueva rama—la radiobiología clínica. La radiobiología clínica se esfuerza por colmar la necesidad de un aborde fisiológico a los problemas que confrontan al radioterapeuta.

En la radioterapia curativa del cáncer, en la que la radiación tiene a menudo que atravesar considerables volúmenes de tejido, el límite de la dosis total lo fija la tolerancia del organismo en conjunto. La respuesta general del organismo debe ser comprobada con mediciones antes y después del tratamiento y durante el mismo.

Dado que el resultado final de un gravamen intenso impuesto al organismo tiene que ser un trastorno del ambiente interno culminando en deterioro de la función celular normal, la tolerancia individual a la irradiación puede probablemente ser expresada por la capacidad existente para la regulación homeostática del transporte de oxígeno. De las cantidades mensurables, la capacidad física para el trabajo podría constituir la expresión más directa de la capacidad del sistema de transporte del oxígeno. No obstante, este concepto necesita apoyo derivado de otras mediciones, y notablemente de las de la hemoglobina total y del volumen sanguíneo. Para este último propósito, el método del monóxido de carbono de Sjöstrand resulta tanto exacto cuanto rápido.

The Threshold Visibility of Pulmonary Shadows[1]

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WHAT SHOULD A radiologist be expected to see on a chest film? What is the size, shape, and contrast of the least perceptible shadow? Yerushalmy (1950) found that 32 per cent of suspicion-worthy pulmonary shadows are missed by "competent" film readers. Birkelo (1947) has shown that 35-mm. photofluorograms are as efficient at detecting pulmonary lesions as is full-sized double-screen technic. A pulmonary tumor 6 mm. in diameter may be close to invisible. How then can vessels from 1 to 3 mm. in diameter produce the obvious lacework of the pulmonary fields? A lung full of tubercles 1.5 mm. in diameter may present an appearance quite easy to diagnose, yet the single 1.5-mm. shadow is below the threshold.

A number of researches on the fundamentals of roentgen visibility have been published. Burger (1949) showed the mutual dependence of size and contrast needed to make a shadow visible, and pointed out the inferiority of fluoroscopy and photofluorography, but he worked with sizes much smaller than most pulmonary lesions. Franke (1942) and Chantraine (1942) carried on a controversy concerning "summation" *versus* "real images." Resink (1949) has written most recently about this. These authors cite a number of earlier workers. Walter (1917) investigated visibility of beveled and curved edges. Steiner (1937) believed visibility of "miliary" tubercles to be dependent on their composition (ash). He showed the relationship, also, of size and number to visibility.

Our own interest in these matters arises from the recently increasing importance of photofluorographic "mass surveys" and a desire to standardize the reading of survey films. It is hard to know what readers are doing a good job unless one knows just how much of a shadow a good reader ought to be able to see.

THRESHOLD SHADOWS

Figure 1 shows a roentgenogram of various objects used to test the threshold of visibility under various circumstances. The visibility could be effectively reduced on plain films by making the exposure very light, or by exposing the film all over (fogging) to 0.5 to 5 times the exposure already given through the test objects.

For objects with sharp edges, we judged all simple shapes (round, square, triangular, etc.) and all sizes, from 5 mm. to 70 mm., about equally visible. This agrees with Burger (1949). Later we thought we detected a slight raising of the threshold for the smaller sharp faint shadows.

At optimum exposure on plain film, the threshold contrast is given by 0.2 mm. of lucite. This is about 0.4 per cent absorption. Unless conditions are optimum, the threshold is about 0.3 mm. lucite or 0.5 mm. wood. Many films were made with a lucite object stuck to the back of the patient's chest. The threshold thickness on a chest film proved to be about 3 mm. (6 per cent absorption).

SHARPNESS OF SHADOWS

Sharpness of the shadow proved important; that is to say, unsharpness makes faint shadows less visible. For quantitative statement we have given our experience as well as we can in terms of visibility, instead of threshold. We have tried to estimate the visibility of various objects above threshold. The unit we have used is the thickness of the faintest visible object. For lucite on plain films this is about 0.3 mm. For lucite through the

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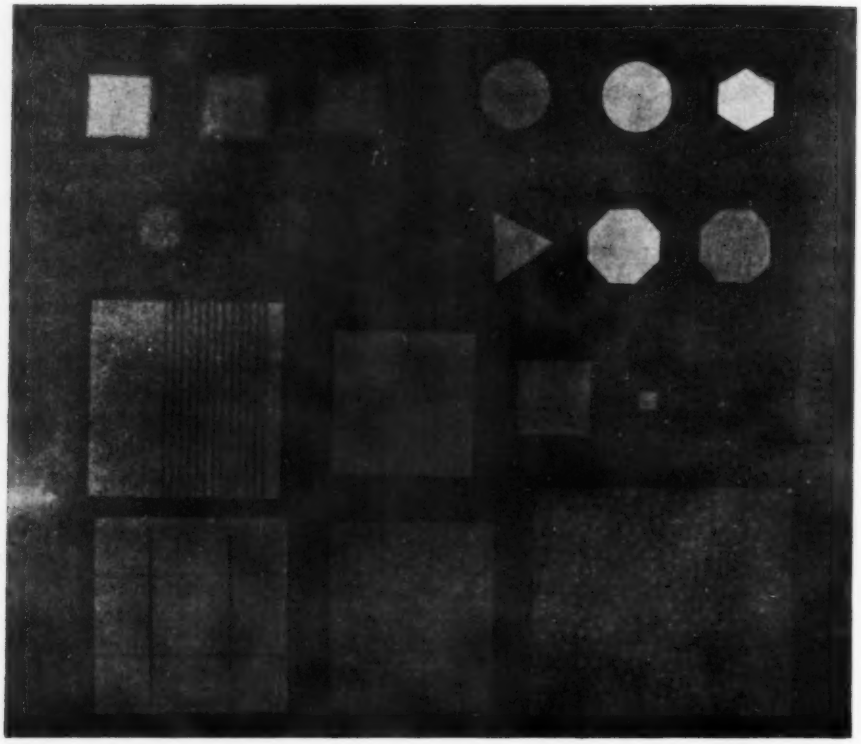

Fig. 1. Lucite objects of diverse shapes and sizes. They have square edges except the three squares at the upper left, which are beveled in various degree, and the left hand disk below these, which is also beveled. The three squares in the middle, of 50, 25, and 6 mm. sides, are all of the same thickness (3.3 mm.). The sawcuts are half way through the upper large square. In the lower square the four cuts are 1 mm., 1.5 mm., 2 mm., and 3.3 mm. (all the way through). The seeds are turnip (1.4 mm. diameter) and millet (1.5 × 2.0 × 2.8 mm.) glued to a sheet of film. The lucite has a density of 1.2. Some wooden disks were also used, of density 0.67.

chest it is about 3 mm. For birch wood on plain films it is about 0.5 mm. To say that one object is 2 units more visible than another means that the addition of two threshold thicknesses to the latter would make their shadows equal. Judgments were made near threshold on films of artificially reduced contrast. Comparisons were always of shadows made at the same exposure of objects placed on the same film. Figure 2 shows the effect of unsharpness, produced by beveling.

SIZE AND VIEWING DISTANCE

In comparing a fuzzy shadow (long bevel) with a sharp one (square edge), it was found that the viewing distance is important. Obviously a given width of bevel appears narrower (subtends a smaller visual angle) the further away it lies from the eye. One would expect data at 105 cm. viewing distance to be brought into agreement with the readings at 35 cm. by multiplying the bevel in millimeters by a factor of one-third. Actually agreement was better by a factor of one-half.

A fuzzy shadow does not look the same as a sharp one when both are judged as barely visible. One is conscious of the extra visibility of the edge and the paling toward the center of the sharp disk. Moreover, their behavior is quite different as viewing distance is increased. The sharp shadow, if very faint, may fall below threshold, but the fuzzy one retains its full visibility. The explanation we offer is this:

As the viewing distance increases, the subtense of the shadow diminishes, both as to width of bevel and total size. But width of bevel has a large effect on visibility, and total size (above 5 mm. seen at 35 cm.) has only a very small effect. The result is actually an increase in visibility as the retinal image becomes smaller.

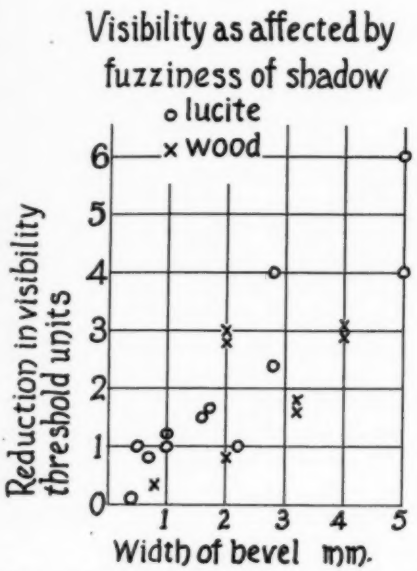

Fig. 2. Effect of unsharpness on visibility. The wider the bevel, the lower the visibility. These comparisons were made at 35 cm. viewing distance. At 105 cm., the bevel had to be about twice as wide for the same effect.

The above effect probably explains why miniature films are found to be as effective as large films for mass survey for tuberculosis (fuzzy shadows), and might account for the relative "over-reading" of these small films (Birkelo, 1947).

SHADOWS IN CHEST FILMS

If several lucite objects about 3.5 mm. thick are radiographed through the chest, the shadows will all be seen by only the sharpest of radiologists. Most readers will see some, not all. It makes little difference whether the object is on the front or back of the chest (rotating anode, 2 mm. focus). Also the visibility is nearly equal in the various parts of the lung fields.

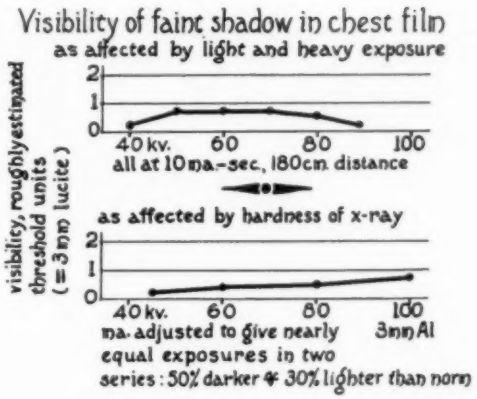

Fig. 3. Effect of exposure and quality on visibility of a lucite object radiographed through the chest. The visibility is just perceptibly lessened in a film that is much too light or much too dark. The visibility increases just perceptibly as one goes from soft qualities to hard ones, becoming definitely improved for the hardest radiographic quality.

KILOVOLTS AND EXPOSURE

Quality of ray is of little importance for visibility. The harder qualities are a little the better. It has long been known that light atoms absorb x-ray mostly by scattering, which changes little with wave length, whereas heavier atoms, like calcium, absorb more by photoelectric mechanism, the absorption coefficient increasing according to the third power of the wave length. In the film obtained by x-rays of harder quality, the shadows of soft-tissue structures are very little changed, but the rib shadows are much diminished and so hide the other shadows less.

Exposure, that is to say the darkness or lightness of the film, is also not a large factor in the visibility of shadows. The exposure must, of course, not be so light or so heavy as to come onto the toe or the knee of the "H and D" curve (density-log exposure curve), or the contrast will be lessened (Mees, 1944). Also it is essential that the development be uniform (optimum, one hopes).

Lucite objects (edges not beveled) of near threshold thickness were stuck to a patient's back and films were made at various densities. Then two more series were run, keeping the density uniform, either slightly lighter or slightly darker

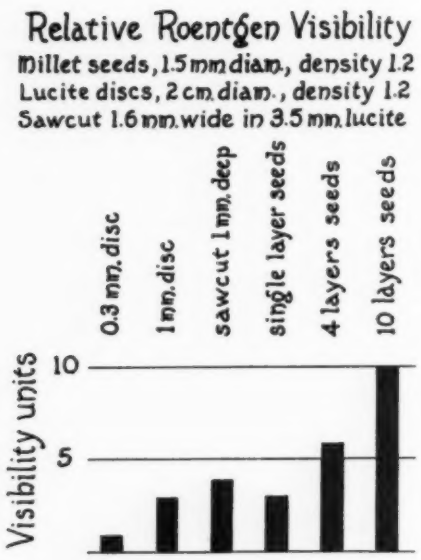

Fig. 4. The influence of repetitive pattern and of superposition (summation) on roentgen visibility, on plain film. Parallel sawcuts are much more visible than a disk of equal physical contrast. Small spheres (seeds) must produce half again as much contrast as a 2 cm. disk to give equal visibility. Superposition of a number of layers of seeds, randomly distributed, increases the visibility very much.

than optimum, but changing the quality of the x-ray. As shown in Figure 3, the variation is less than one "threshold unit," which in terms of perception is judged to be clinically pretty unimportant.

VISIBILITY OF PATTERNED SHADOWS

Repetitive patterns increase visibility. Parallel sawcuts half way through a lucite sheet are more visible than the full-thickness outline of the whole sheet. This is true both for plain film and films obtained through the chest. In fact, the effect is more striking on the chest films.

Through the chest, a single scattered layer of millet seeds is less visible than parallel sawcuts of equal depth. Larger seeds (vetch) are more visible than a lucite sheet of equal thickness and about equal in visibility to a set of sawcuts half way through the sheet. But only a few of the seeds are seen. Although all the sawcuts are seen, the visibility fluctuates along their length.

On plain films, if millet seeds and sawcuts are superimposed, one can detect the seeds by the raggedness they impose on the sawcut shadows, even when the seeds alone are below the threshold.

It seems to us that we can see enhancement of visibility by two mechanisms, namely: psychological (expectation) and physical (summation). Expectation could be called a kind of summation, too.

Psychological Summation of Shadows: Psychologically, one can say, where multiple similar stimuli are presented, that they can reinforce each other to a sufficient degree to raise the perception above the threshold. A more objective way to look at it might be on the basis of frequency of seeing (Lamar, Hecht, Hendley, and Shlaer, 1948). The threshold of vision is not sharp. There is a range over which the frequency of seeing varies from zero (completely invisible) up to 1.0 (seen every time). A stimulus seen infrequently would be judged below the threshold, yet if presented many times, it would produce a few positive responses. A repetitive pattern does in effect present the stimulus (or rather similar stimuli) many times. Perception is evidently able to integrate the rare random signals of "subliminal"

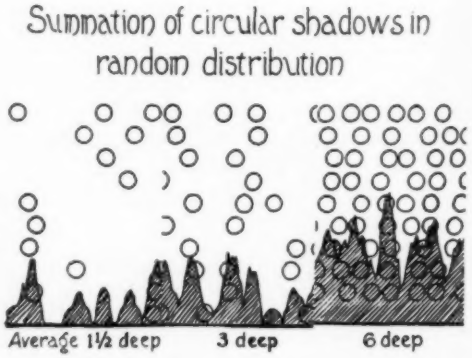

Fig. 5. Summation of absorption of x-ray due to superposition of round absorbers randomly distributed. The profiles at the base of the figure show the total amount of material that the x-ray must pass through, supposing the rays fall vertically. This is calculated for the plane passing through the centers of the balls, all the balls lying in one plane parallel to the plane of the page. In actual chest radiography, the tubercles are distributed randomly in all directions.

stimuli into real visibility. Note that this seems to work better for a regular pattern (sawcuts) than for a random pattern (scattered seeds).

Physical Summation of Shadows: The shadows of the pulmonary vessels overlap and cross in places. By this we mean that there are places where the x-ray has to pass through one vessel, and other places where it has to pass through two, etc. Although a 1-mm. vessel casts a subliminal shadow, yet two such vessels give an absorption of x-ray which may bring the combined shadow (at the crossing) above the threshold. The visibility of the seeds or the sawcuts seen through the chest is enhanced in this way by the chance coincidence with pulmonary vessel shadows ("lung markings"). This works more for sawcuts and millet seeds than for a lucite disk because the multiplicity of the cuts and the seeds gives so many more chances for such coincidences.

Such overlapping of small faint shadows is the basis for perception of miliary tubercles, as Resink (1949) and the earlier workers pointed out. Experimentally this is easy to imitate by radiographing a number of layers of scattered seeds. The increasing visibility with increasing number of layers is shown in Figure 4.

To calculate the probability function appears difficult, but it is easy to make a graphical solution for the analogous two-dimensional case. Figure 5 shows the sum of absorption of x-rays passing vertically through a number of rows of circles, distributed at random in each row. Suppose these circles represent mustard seeds 1.4 mm. in diameter. Such seeds cast a visible shadow on plain film but are invisible through the chest. Such circles arranged close-packed in three layers will show a non-uniform absorption of x-ray. The ray absorbed the most will go through three diameters (4.2 mm.), but this requires a ray at 30 degrees from the vertical. A truly vertical ray could go through three 60-degree chords, giving a maximum path of 3.6 mm. The minimum path would be that of a vertical ray passing between

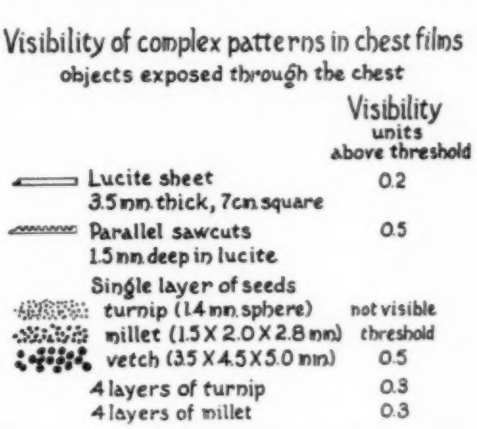

Fig. 6. Visibility of various light objects radiographed through the chest, to show increased visibility by repetition and by superposition (summation).

circles on top and bottom layers and through the full diameter in the middle layer. The difference (3.6 − 1.4) is 2.2 mm.

Now if these are not close-packed, but are randomly distributed in the same concentration (21 per centimeter), there will be by chance some places (though small and few) which are not covered at all, and some places where the circles overlying pile up to a total of more than 4 mm. Thus we see that random distribution gives occasional contrast twice what a uniform triple layer would give. The summation of this concentration of circles is shown in the middle section of Figure 5. At the sides are shown concentrations half as much and twice as much. It is seen that the peaks come along two or three diameters apart, and that the higher concentrations give, on the whole, higher peaks, some peaks rising to five diameters for a concentration of 42 per centimeter. This means peaks equivalent to 7 mm. produced by summation of 1.4 mm. circles.

The amount of increased visibility due to this summation effect is shown in Figures 4 and 6 for plain films and as seen through the chest.

CONCLUSIONS

The faintest visible shadow on x-ray film is cast by a lucite disc 0.2 mm. thick.

This has an x-ray absorption of about 0.4 per cent.

The visibility of a sharp shadow is unaffected by the size, if larger than 0.5 cm. Simple shapes (circle, square, triangle, etc.) are equally visible.

Fuzziness of outline lessens visibility by about one threshold unit for every millimeter of fuzziness at 15-inch (38-cm.) viewing distance. This effect of fuzziness diminishes with increasing viewing distance, so that it is only for sharp shadows that large visual subtense is of much advantage. This explains why pulmonary lesions (fuzzy shadows) are detected as dependably on minifilms as on 14 × 17-in. films.

Shadows with a repetitive pattern are more visible than simple shadows of the same contrast. This effect is more marked for regular than for random patterns. Small objects of subliminal x-ray absorption may be brought above the threshold by summation of their shadows, even when they are distributed at random; also, when photographed through the chest, by addition of their shadows to subliminal or supraliminal linear shadows of pulmonary vessels.

On films made through the chest, about ten times the contrast is required for threshold visibility as on plain films. It makes little difference for the visibility of faint shadows whether the chest film is heavily or lightly exposed, within reasonable limits.

The hardness of the x-ray used for chest radiography makes little difference in the visibility of faint pulmonary shadows, but what difference there is favors the harder quality (100 kv. with 3 mm. Al filter).

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SUMARIO

La Visibilidad Mínima de las Imágenes Pulmonares

A fin de determinar precisamente lo que cabe esperar que vea un radiólogo en una radiografía torácica, los AA. tomaron una gran cantidad de radiografías con un objeto de lucita adherido al dorso del tórax de un enfermo. La más débil sombra visible en condiciones de exposición óptima fué lanzada por un disco de lucita de 0.2 mm. de espesor, que muestra una absorción de unos 0.4 por ciento de rayos X. La visibilidad de una sombra bien delineada no fué afectada por el tamaño, si éste excede de 0.5 cm. Las formas simples (circular, cuadrada, triangular, etc.) resultaron ser igualmente visibles.

La borrosidad del contorno rebajó la visibilidad aproximadamente en una unidad umbral por cada milímetro de borrosidad a una distancia de 38 cm. de observación. Este efecto de borrosidad disminuyó a medida que aumentaba la distancia de observación, lo cual explica

porqué se descubren las lesiones pulmonares (sombras borrosas) en las microrradiografías con tanta precisión como en las películas de 35 × 42.5 cm.

Las sombras que se conforman a un patrón repetido, como las lanzadas por una capa esparcida de granos de mijo, fueron más visibles que sombras sencillas del mismo contraste, siendo este efecto más pronunciado con los patrones regulares que con los formados al azar. A los pequeños objetos de absorción subliminar de rayos X puede elevárseles sobre el umbral por medio de la suma de sus sombras, aunque estén distribuídas al azar; y además, cuando se fotografían a través del tórax, por medio de la adición de sus sombras a las sombras lineales, ya sub- o supraliminares, de los vasos pulmonares.

En las radiografías tomadas a través del tórax se necesita para la visibilidad umbral unas diez veces el mismo contraste que en las corrientes. Para la visibilidad de sombras débiles, poco importa, dentro de límites razonables, que el tórax sea intensa o ligeramente expuesto.

La dureza de la radiación utilizada para la radiografía torácica crea poca diferencia en la visibilidad de sombras pulmonares débiles, pero la diferencia que haya es en pro de la clase más dura (100 kv. con filtración por 3 mm. de Al).

The Diagnostic Accuracy of the Roentgen Examination in Diseases of the Upper Gastro-Intestinal Tract[1]

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MANY TIMES THE roentgenologist is asked by the referring physician "How accurate is the roentgen examination of the upper gastro-intestinal tract?" The percentage of accuracy depends greatly upon the experience of the examiner; various figures are given by different authors. Davis (2) stated that in peptic ulcer the diagnosis of the average roentgenologist should be 75 to 80 per cent correct. Smithies (9) found that preoperative roentgenograms show about 50 per cent agreement with operative findings in cases of gastric ulcer and between 60 and 70 per cent agreement in duodenal ulcer. Hartley (4) emphasized the importance of the time interval between the roentgen examination and surgery in correlating the roentgenographic and surgical findings. He believed that an ulcer may develop or disappear radiologically in six weeks.

In an attempt to determine the accuracy of the roentgen examinations of the upper gastro-intestinal tract at the U. S. Marine Hospital (Staten Island), the preoperative roentgen findings were correlated with the operative findings in 202 cases seen during the years 1942–48. Only cases in which the time interval between the roentgen examination and surgery did not exceed seven weeks were included in this study. Many cases were excluded because of the excessive time lapse. The cases were divided into eight groups, as follows:

Duodenal ulcer	84
Solitary gastric ulcer	54
Combined duodenal and gastric ulcers	3
Gastric neoplasms	33
Previous gastro-enterostomy	9
Extrinsic lesions	5
Miscellaneous gastric lesions	7
No disease	7

All the diagnoses of gastric ulcer and carcinoma were confirmed by the histopathology.

In the 84 cases of duodenal ulcer the roentgen and surgical pathologic diagnoses agreed in 74 cases, or 88 per cent. The roentgenologic interpretations of the 10 cases in which the findings were proved incorrect at operation were:

Ulcer on gastric side of pyloric ring	6
Cancer of the pylorus	2
Ulcer on lesser curvature of stomach	1
No evidence of disease in stomach or duodenum	1

It is noted that in 6 of the 10 misdiagnosed cases the roentgenologist interpreted the ulcer as being on the gastric side of the pyloric ring. If these discrepancies are not counted, the accuracy compares favorably with that of Mailer (5), who reported surgical and roentgenographic agreement in 95 per cent of 121 cases of duodenal ulcer. In his series similar discrepancies were not considered as misdiagnosis.

The agreement in 88 per cent of the duodenal ulcer group compares favorably with the report of Marquis and Baker (6), who found roentgenologic and surgical correlation in 82.5 per cent of 53 patients with duodenal ulcer. Miller, Pendergrass, and Andrews (7), in their series of 100 operated duodenal ulcers, found the preoperative roentgen diagnosis to be correct in 88 per cent of cases.

Surgical-pathological diagnosis of solitary gastric ulcer was made in 54 instances. The roentgen and surgical pathological diagnoses agreed in 49 cases or 90.7 per cent. The roentgenologic interpretation of the 5 misdiagnosed cases was as follows:

[1] From the U. S. Marine Hospital, Stapleton, Staten Island, N. Y., operated by the U. S. Public Health Service in the Federal Security Agency. Accepted for publication in July 1950.

[2] Resident in Roentgenology.

[3] Chief, Department of Roentgenology.

Ulcer in the duodenal bulb	4
No disease	1

Miller, Pendergrass, and Andrews reported agreement in 34 of 36 cases of gastric ulcer, an accuracy of 94 per cent. In Mailer's (5) series of 29 gastric ulcers there was surgical and roentgenographic agreement in 27 or 93 per cent. Harding (3), whose series comprised 10 cases, reported that in 2 instances the roentgen diagnoses were only partially correct.

Combined duodenal and gastric ulcers were present in 3 cases. In 2 of the 3 patients both lesions were diagnosed by the preoperative roentgen examination. Roentgenologic examination of the remaining case revealed an ulcer in the duodenal bulb. At operation an additional ulcer was found high on the lesser curvature of the stomach.

Carman (1), in 1917, reported 16 cases in which both duodenal and gastric ulcers were found at operation. The presence of both ulcers was discovered roentgenologically in 7 of the 16 cases.

Thirty-three gastric neoplasms were included in this study. In 30 cases, or 90.9 per cent, the preoperative roentgen diagnosis was correct. The radiographic diagnoses in the 3 cases in which disagreement occurred were as follows:

Extra-gastric lesion	1
Duodenal ulcer	1
Gastric ulcer	1

In 1914 White and Leonard (11) reported correct roentgenologic diagnoses in 89 per cent of gastric carcinomas. More recently Harding (3) reported 100 per cent surgical and radiologic agreement in 9 cases. In Mailer's (5) series of 13 cases, the roentgen diagnosis was confirmed by operation in all. Walters (10), in a series of 2,469 cases of gastric carcinoma, found roentgen and surgical agreement in 75.3 per cent.

Operation was performed on 9 patients who had recurrent symptoms following gastro-enterostomy. The findings were placed in a special category for the purposes of this study. They are compared in Table I. In 6 instances, the roentgen findings were confirmed by operation.

TABLE I: ROENTGEN AND SURGICAL FINDINGS IN GASTRO-ENTEROSTOMY CASES

Roentgen Diagnosis	Surgical Diagnosis
Deformed duodenal bulb. No marginal ulcer seen	Chronic scarring of duodenum and marginal ulcer on gastric side of gastrojejunostomy
Penetrating prepyloric ulcer. No gastro-enterostomy seen	Duodenal ulcer 1½ inches distal to pylorus. Gastro-enterostomy not functioning
Probably ulcer in pylorus or duodenal bulb	Healed gastrojejunal ulcer. No ulcer in duodenum
Chronic ulceration of duodenal bulb and ulcer niche in jejunum just distal to stoma	Ulcer of duodenum and marginal ulcer at stoma. Scarring of duodenum distal to pylorus
Gastro-enterostomy present. Ulcer in afferent loop close to stoma	Posterior gastro-enterostomy with marginal ulcer present
Deformed duodenal bulb. Also ulcer on jejunal portion of gastro-enterostomy	Marginal ulcer present. Scarring present on anterior wall of first part of duodenum
Deformity of distal stomach. Gastro-enterostomy not functioning. Ulcer crater on greater curvature of stomach	Recurrent ulcer on greater curvature. Distal part of stomach adherent to liver
Poor functioning gastro-enterostomy. Deformity of duodenal bulb due to scarring	Malfunctioning gastro-enterostomy. Pyloric obstruction due to scarring
Gastro-enterostomy functioning. Duodenal bulb deformed and dilated	Scarring and deformity of first portion of duodenum with constriction

The diagnosis of carcinoma of the head of the pancreas was made at the operating table in 5 cases, and was confirmed by pathologic examination. These cases were placed in the group of extrinsic lesions. In 2 instances the preoperative roentgen diagnoses were correct. In another case, an ulcer was seen on the lesser curvature of the stomach roentgenologically and surgery was advised. At the operation an ulcer was found and a large tumor of the pancreas was also discovered. The pathological report was carcinoma of the head of the pancreas with metastases. In the remaining 2 instances the roentgen examination failed to reveal any deformity of the stomach or duodenum.

Seven cases are placed in a group of miscellaneous conditions. In only 1 of these cases did the roentgen and surgical findings agree. The roentgenological and surgical diagnoses are listed in Table II.

TABLE II: MISCELLANEOUS GROUPS

Surgical-Pathologic Diagnosis	Roentgen Diagnosis
Hypertrophic gastritis	Prominent rugal folds of stomach with ulcer in center
Hypertrophic gastritis	Hypertrophic gastritis
Hypertrophic gastritis	Polypoid tumor in fundus
Gastro-colic fistula	Deformed duodenal bulb
Chronic inflammation of stomach	Duodenal ulcer
Stomach normal, ileitis present	No lesion
Hypertrophic gastritis	Gastric neoplasm

A final group consisted of 7 patients in whom no lesion was found at operation. In 2 of these cases the preoperative roentgen examination also failed to reveal any disease. In 2 cases the roentgen diagnoses of prepyloric ulcer and antral cancer were made. At operation the stomach was not opened and palpation failed to reveal a lesion in either case, though the possibility of its presence is a real one. Moore (8) quotes Judd as saying that the diagnostic and roentgen sections in his clinic are not considered in error in gastric and duodenal ulcers unless he has opened the viscus and inspected the mucosa. The roentgen and surgical diagnoses of the cases in this group are shown in Table III.

TABLE III: CASES WITHOUT LESIONS AT OPERATION

Surgical Diagnosis	Roentgen Diagnosis
No lesion (stomach not opened)	Prepyloric ulcer
No lesion (stomach not opened)	Cancer in prepylorus
No lesion	Antral gastritis with questionable ulcer in pylorus
No lesion	Prepyloric stiffness but findings not sufficient to warrant diagnosis of cancer
No lesion	Surgical lesion at pylorus
No lesion	No lesion
No lesion	No lesion

SUMMARY

The results of roentgen examination of the upper gastro-intestinal tract of 202 patients are compared with the surgical findings. In 84 cases of duodenal ulcer the roentgen and surgical findings were in agreement in 88 per cent. The roentgen diagnosis was correct in 90.7 per cent of 54 cases of gastric ulcer and in 90.9 per cent of 33 gastric neoplasms.

NOTE: The authors appreciate the aid and interest of Dr. Homer L. Skinner, Chief of the Surgical Service and Dr. Lawrence Sophian, Chief of the Pathological Service, for making available the records of their departments.

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SUMARIO

La Exactitud Diagnóstica del Examen Roentgenológico en las Enfermedades de la Porción Superior del Tubo Digestivo

Los resultados del examen roentgenológico de la porción superior del tracto gastrointestinal de 202 enfermos son comparados con los hallazgos quirúrgicos. En 84 casos de úlcera duodenal, los hallazgos roentgenológicos y los quirúrgicos convinieron en 88 por ciento. El diagnóstico roentgenológico resultó acertado en 90.7 por ciento de 54 casos de úlcera gástrica y en 90.9 por ciento de 33 neoplasias gástricas. En 2 de 3 casos en que había presentes úlceras duodenal y gástrica combinadas, ambas lesiones fueron diagnosticadas roentgenológicamente.

Radiation Sickness and Its Treatment with Dramamine[1]

EDWARD DeFEO, M.D.[2], PAUL H. REITMAN, M.D.[3], and M. HERBERT NATHAN, M.D.

RADIATION SICKNESS has long been considered a complicating factor in the treatment of disease by radium and roentgen rays. It may manifest itself mildly or exhibit such severity as to interfere seriously with the proper administration of essential therapy, the symptoms varying from lassitude, anorexia, and nausea, to severe vomiting, diarrhea, and prostration.

In the experience of the present writers, reactions of this nature have not proved a serious obstacle to therapeutic irradiation. In a specific survey of 668 consecutive patients, 100 cases of radiation sickness were observed, an incidence of 15 per cent, and this only when persistent nausea of the mildest nature arising during treatment, with no other demonstrable cause, was taken as the criterion. The symptoms have been graded according to severity from + to ++++, as follows: +, mild nausea; ++, moderate nausea; +++, nausea with vomiting; ++++, nausea and vomiting severe enough to warrant discontinuation of treatment (Table I).

TABLE I: CLASSIFICATION OF RADIATION SICKNESS BY SEVERITY IN 100 CASES

+	43 cases
++	41 cases
+++	15 cases
++++	1 case
TOTAL	100 cases

The symptom complex of radiation sickness is believed to be the result of a disturbed metabolism and represents a general response to radiation. What underlying factor, or factors, is most significant is difficult to determine because of the many variables in radiotherapy—the patient, the dosage, the area treated, the tissue volume irradiated, and the particular site to which the radiation is directed. We have found the incidence to be highest when large areas are treated, when irradiation is given to the abdominal region, and when the daily dosage exceeds 400 r to the skin (Table II). It is significant, also, that in our series all those patients receiving over 300 r per treatment were being treated daily for malignant tumors, while of the 13 who received less than 300 r per treatment 6, or nearly half, had benign lesions, as bursitis and periarthritis, for which two treatments per week, of 150 r each, were given. The fact that in this latter group disproportionately severe symptoms (Table III) followed relatively small doses indicates the possibility of a psychogenic factor. A suggestion by the referring physician that symptoms may develop is often cause enough for their occurrence even with low doses to small areas.

TABLE II: INFLUENCE OF AMOUNT OF IRRADIATION ON RADIATION SICKNESS

Group	r per Treatment 100–300	300–500	50 (Spray)	Total
+	5	37	1	43
++	6	33	2	41
+++	2	13	0	15
++++	0	1	0	1
TOTAL	13	84	3	100

Theories as to the cause of radiation sickness and methods for its treatment

TABLE III: INCIDENCE OF BENIGN AND MALIGNANT LESIONS IN SERIES

Group	Benign	Malignant
+	3	40
++	1	40
+++	2	13
++++	0	1
TOTAL	6	94

[1] From Tumor Clinic (Erich M. Uhlmann, M.D., Director), Michael Reese Hospital, Chicago, Ill. Accepted for publication in July 1950.

[2] Trainee of National Cancer Institute.
[3] Assistant Director, Tumor Clinic.

TABLE IV: RESULTS WITH DRAMAMINE THERAPY

Group	Dramamine		Placebo		Absolute Rate of Improvement with Dramamine
	Not Improved	Improved	Effect	No Effect	
+	22	21	9	0	12
++	19	22	7	6	15
+++	12	3	1	1	2
++++	1	0	0	0	0
TOTAL	54	46	17	7	29

have been appearing since 1907 (1). It is not within the scope of this paper to review the voluminous literature. This has been most ably accomplished by Shorvon (2), who briefly describes some sixteen etiologic theories and mentions some twenty-four drugs used in treatment. Several new drugs have been added to the list since the publication of his paper, including desoxycorticosterone (3) and the antihistamines (4), of which dramamine is the most recent.

Our interest was aroused in dramamine because of conclusive evidence of its value in controlling the nausea and vomiting of motion sickness (5), and we began administration of the drug in cases of radiation sickness half an hour before each meal and at bedtime, as soon as symptoms appeared. Since all radiation treatments were given in the morning, between the hours of 8:30 and 12:30, the maximum time elapsing between a treatment and any one dose of dramamine was two hours, and in the majority of instances the interval was much shorter. Symptoms of radiation sickness appeared on an average of 5.3 days after treatment had been instituted. Conventional deep roentgen therapy was given in all cases.

Our early experience with dramamine was not over-encouraging, and we would have stopped its routine administration except for the appearance of a paper by Beeler, Tillisch, and Popp (6), of the Mayo Clinic, reporting favorable results in a series of 80 patients. This prompted us to continue the use of the drug, and 100 patients were given dramamine as soon as symptoms of radiation sickness appeared.

In only 46 of these 100 patients was any improvement noted following dramamine (Table IV). One-half of this number had no recurrence of symptoms after administration of the drug for one day (400 mg.). In the remainder, it had to be given daily throughout the period of irradiation. In the latter group symptoms recurred on an average of 2.1 days after the drug was discontinued.

Because of this recurrence of symptoms, we were able to observe the effect of placebos given at intervals during irradiation in 24 of the 46 patients claiming improvement with dramamine. The placebo was identical in appearance and taste to the drug.[4] Seventeen of the 24 patients (70 per cent) did as well with the placebo as with the drug itself, reducing the actual number of patients whose improvement could be credited to dramamine to 29.

These results emphasize the important role of psychogenic factors in radiation sickness, and the care which must be exercised in drawing conclusions as to the effectiveness of any drug in a syndrome in which criteria of improvement are mainly subjective. Evaluation of the response of a drug by comparing its effectiveness to that of a placebo is best accomplished when both can be administered to the same patient, as in our series. It is our opinion, also, that reasonable conclusions cannot be drawn by comparing results in a group of patients receiving dramamine with those in a separate control group.

[4] The authors wish to thank W. C. Searle Co., of Chicago, Ill., and Dr. I. M. Winters, the Director of Clinical Research, for their co-operation in supplying us with dramamine and the placebo.

Radiation sickness does not occur so uniformly nor with so high an incidence that a reliable control can be established.

In 11 of the cases in our series dramamine produced undesirable side effects, consisting of intense drowsiness in 6, giddiness in 3, and a metallic taste in 2. The drowsiness was of such a degree that the medication had to be discontinued, since this side effect was more debilitating than the radiation sickness.

From our experience, we believe that the effectiveness of dramamine in radiation sickness is proportional to its antihistaminic effect, and it is generally known to be one of the less effective of the antihistamines. The problem of radiation sickness will not be solved until there is more general agreement as to its cause. Only then can treatment be directed to the underlying factors and not to the symptoms alone.

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SUMARIO

La Enfermedad de Irradiación y Su Tratamiento con la Dramamina

Los AA. observaron que la enfermedad de irradiación ocurría más frecuentemente cuando se irradiaban zonas grandes, cuando se asestaba la radiación al abdomen y cuando la dosis diaria excedía de 400 r a la piel. Sin embargo, también se observó esa reacción contraproducente con dosis hasta de 150 r, administradas dos veces por semana, para lesiones benignas.

La dramamina, droga antihistaminica que ha resultado útil para cohibir las náuseas y vómitos debidos a las cinesipatías, fué usada en una serie de 100 sujetos con enfermedad de irradiación durante el transcurso de la roentgenoterapia profunda convencional. Obtúvose así mejoría en 46 de ellos, pero en 24, los síntomas recurrieron al abandonarse la droga. El tratamiento de este grupo con un placebo idéntico en aspecto y sabor a la dramamina produjo resultados buenos iguales a los de la droga en 17 casos. Por consiguiente, bajó a 29 el número real de enfermos en los que cabe imputar la mejoría a la dramamina.

Opinan los AA. que sus observaciones señalan la intervención de un factor psicógeno en muchos casos de enfermedad de irradiación. Para ellos, la efectividad de la dramamina se halla en proporción a su acción antihistamínica, que, según es sabido, es relativamente leve.

Situs Inversus of the Abdominal Viscera with Volvulus of the Large Bowel

Report of a Case[1]

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SITUS INVERSUS of the abdominal viscera is not a rare condition. Its occurrence without dextrocardia is considerably less common (1). We have encountered an unusual case of the latter type with other abdominal malformations, resulting in an acute abdominal episode the nature of which was suggested preoperatively by roentgenographic interpretation. A review of the literature failed to reveal a similar case.

Adams and Churchill (2) state that it seems reasonable to assume that there are two types of individuals with transposition of the viscera. The first is the true mutant, in whom the tendency to transposition is inherited as a recessive characteristic. The second is the true monster, in whom the transposition is the result of external influences acting after fertilization.

It is well known that along with situs inversus many other developmental anomalies occur. These may be in the form of abnormalities of rotation of the gut and inadequate fixation of portions of the intestine. The case which we are presenting revealed both of these disturbances of development.

Volvulus is most commonly observed in the sigmoid flexure of the colon; the cecum and the small intestine are less common sites. A long flexure in which the limbs of the loop are closely approximated, as in the sigmoid colon, predisposes to the occurrence of volvulus. Volvulus of the transverse colon is rare because of the wide attachment of its mesocolon. Despite the wide range of motion of the transverse colon, it usually escapes twisting because its points of fixation at the hepatic and splenic flexures are so far removed from one another (3). However, if there is an anomalous development of the transverse mesocolon changing these normal characteristics, volvulus can occur.

CASE REPORT

R. J. W., a 29-year-old colored male, was admitted to the hospital on March 18, 1950, because of abdominal pain. He was well until 7:00 A.M. of the day of admission, when he began to experience crampy abdominal pain, intermittent in character and periumbilical in location, radiating toward the right upper quadrant. He vomited twice on the day of admission, the vomitus containing bile and previously ingested food. He had a regular bowel movement on the day prior to admission and a small bowel movement on the day of admission. He passed a small amount of gas by rectum shortly after entering the hospital.

The patient gave a history of a similar episode in 1943, while he was in the Army. At that time he was treated conservatively in an Army hospital for ten days and the symptoms subsided. Since 1943 he had experienced repeated episodes of abdominal pain, milder in nature.

The patient was well developed and well nourished, and in acute distress. Physical examination showed nothing of significance except for moderate distention of the abdomen and tenderness to palpation in the epigastrium and right upper quadrant. There was some generalized tenderness in the lower abdomen. On auscultation, peristaltic sounds were active throughout. No masses or viscera were palpable. Rectal examination was negative. The white blood cell count was 3,250 (neutrophils 43, lymphocytes 23, monocytes 8, eosinophils 10). The red cell count was 5,560,000; hemoglobin 19 gm. A second white cell count was 5,000. Serologic tests were negative. Other blood findings were: total protein 6.6; blood chlorides 507. Urinalysis was negative.

A roentgenogram of the chest was normal, showing

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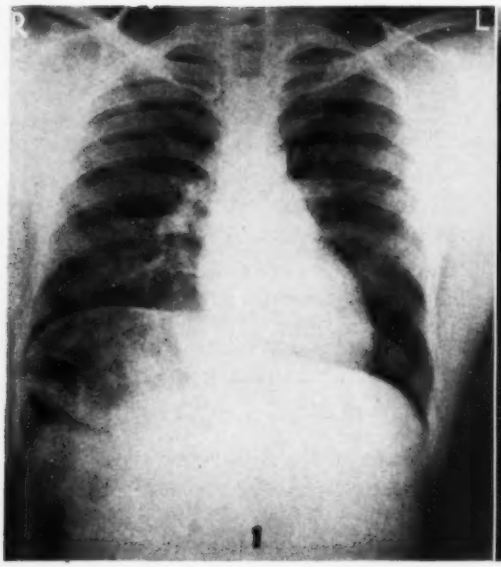
[1] From the Department of Radiology, Veterans Administration Hospital, Bronx, New York. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration. Accepted for publication in September 1950.



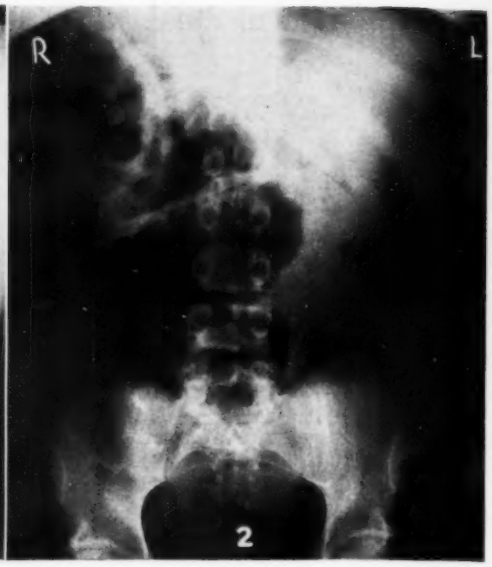


Fig. 1. Chest roentgenogram showing normal position of the heart and elevation of the right diaphragmatic leaflet with accumulation of gas-filled bowel below it.

Fig. 2. Supine roentgenogram showing dilated loops of large bowel filling the right half of the abdomen.

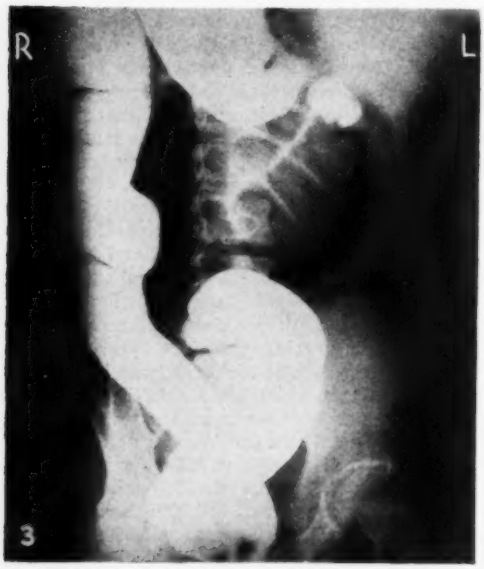
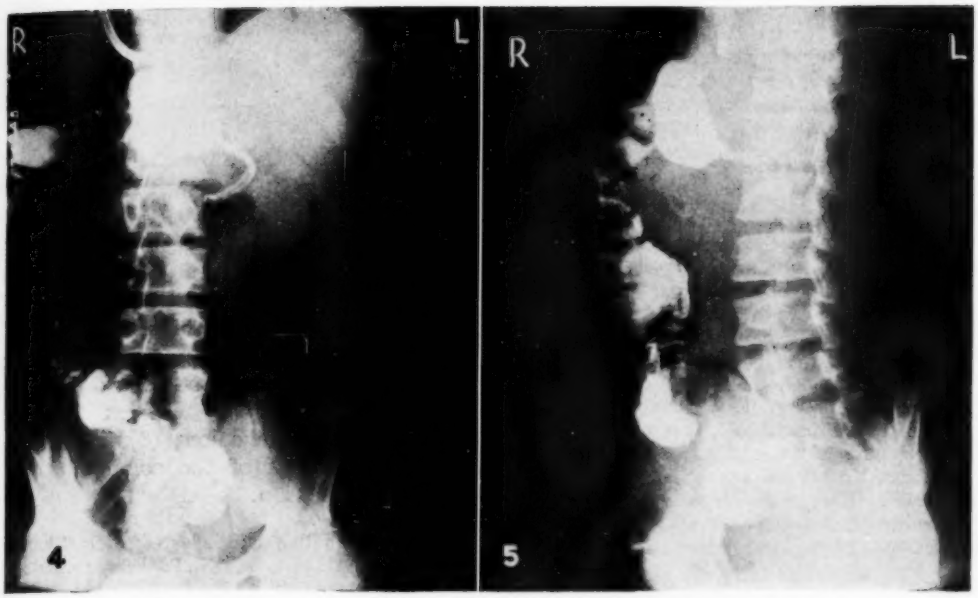


Fig. 3. Barium enema study, demonstrating situs inversus of the large bowel and obstruction at the mid-transverse colon. Dilated loops of colon are seen proximal to the obstruction.

the heart in its usual position. The right diaphragmatic leaflet was elevated, with an abnormal accumulation of gas-filled bowel below it (Fig. 1). Roentgenograms of the abdomen showed marked distention of bowel in the right side of the abdomen (Fig. 2), with fluid levels demonstrable in the erect and decubitus positions. The apparent presence of haustrations suggested that this was large bowel. The left side of the abdomen was practically free of gas-containing structures. An emergency barium enema study was done on the day of admission. Under fluoroscopic control the barium was seen to course to the right and enter the sigmoid colon, descending colon, and transverse colon, all of which were situated in the right side of the abdomen. The barium flow was interrupted at the mid-transverse colon. Roentgenograms confirmed the fluoroscopic impression (Fig. 3) and demonstrated the nature of the obstruction at the mid-transverse colon (Figs. 4 and 5). Here, there was noted a cone-like narrowing at the zone of obstruction which suggested a volvulus. On the right side of the abdomen, medial to the barium-filled descending colon were distended loops of large intestine (Fig. 3). The roentgenographic interpretation was situs inversus and intestinal obstruction at the mid-transverse colon, with volvulus a possibility.

Operation was performed on March 18, 1950. When the abdomen was opened, distended loops of large bowel were found in the right upper quadrant. A small amount of milky white peritoneal fluid was present. The large bowel was delivered through the abdominal incision. It was then observed that the distended bowel consisted of cecum, ascending colon, and half of the transverse colon. It was



Figs. 4 and 5. Post-evacuation roentgenograms showing volvulus with obstruction at the mid-transverse colon.

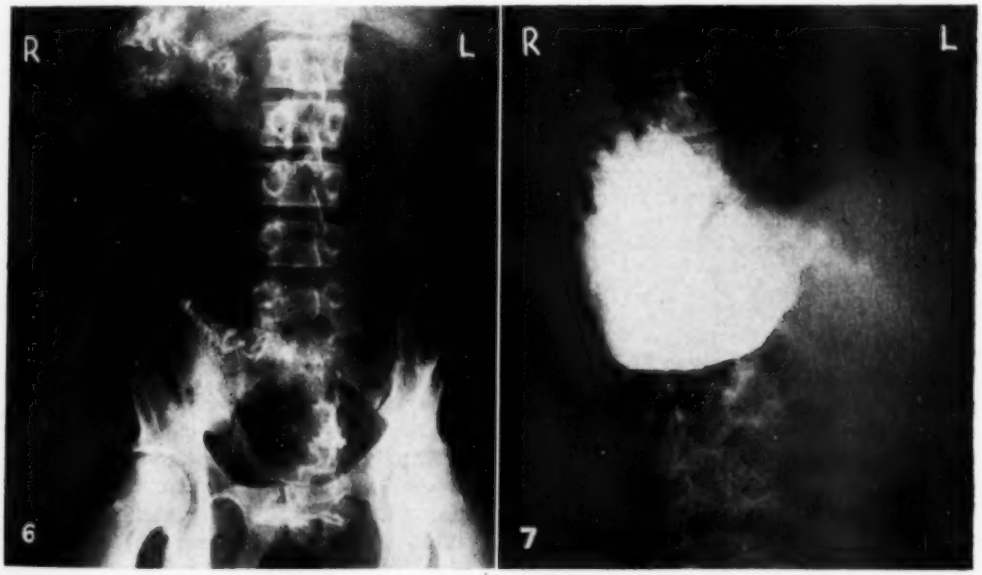


Fig. 6. Postoperative post-evacuation roentgenogram showing situs inversus of the large bowel with the cecum in the left lower quadrant, where it had been fixed by the surgeon.

Fig. 7. Postoperative view of the barium-filled stomach, showing the fundus on the right with the pylorus pointing toward the left.

also seen that this entire portion of the colon was freely mobile within the abdomen, its only attachment being by way of a mesentery having its origin in the transverse mesocolon. A fine congenital band across the transverse colon had served as a fulcrum about which the mobile ascending and first half of the transverse colon had angulated, producing volvulus and intestinal obstruction.

On further exploration of the abdomen, it became apparent that there was a complete situs inversus of all the gastro-intestinal viscera. The fundus of the stomach was in the right upper quadrant beneath the diaphragm. The first portion of the duodenum was on the left side. The ligament of Treitz was on the right side. The liver consisted of two roughly equal lobes, the gallbladder being imbedded in the left lobe. The spleen consisted of three quadrilateral pulpy masses attached by ligament to the fundus of the stomach, the right diaphragmatic leaflet, and retroperitoneal tissues. The sigmoid colon and its mesentery were on the right side. The descending colon was suspended by a completely formed mesentery which was continuous with the transverse mesocolon, on which were suspended the transverse colon, ascending colon, and cecum. The mesentery at the cecal end was of such length as to allow complete mobility within the abdomen of the cecum and ascending colon. The cecum, in rotating into the right upper quadrant, had constricted the transverse mesocolon over the congenital band previously noted. A tube was inserted through the rectum up to the splenic flexure. All gas content was expressed through the tube. The congenital band constricting the transverse colon was cut and the cecum was tacked into the left lower quadrant of the abdomen. The patient made an uneventful recovery.

A postoperative barium enema showed the situs inversus of the colon, with the cecum now fixed in the left lower quadrant (Fig. 6). A barium meal study was also performed and the gastric transposition described at operation was demonstrated (Fig. 7).

SUMMARY

A case of acute intestinal obstruction due to volvulus in association with other interesting anomalies is presented. The findings were as follows: (1) normally positioned chest viscera, including the heart; (2) situs inversus of the abdominal viscera; (3) malrotation of the cecum and "cecum mobile"; (4) congenital band across the mid-transverse colon; (5) abnormal mesenteric attachment to the proximal half of the colon; (6) volvulus of the proximal half of the colon with intestinal obstruction.

NOTE: The authors are indebted to Dr. Charles Gottlieb and Dr. Maxwell H. Poppel for their aid in preparation of this paper.

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SUMARIO

Situs Inversus de las Vísceras Abdominales con Vólvulo del Intestino Grueso. Presentación de un Caso

El caso descrito es de oclusión intestinal aguda debida a vólvulo y asociada a otras anomalías interesantes. Los hallazgos fueron los siguientes: (1) vísceras torácicas, incluso el corazón, en su posición normal; (2) situs inversus de las vísceras abdominales; (3) malrotación del ciego y "cecum mobile"; (4) banda congénita a través del colon mesotransverso; (5) inserción anormal del mesenterio en la mitad proximal del colon; (6) vólvulo de la mitad proximal del colon.

Fracture of the Spinous Processes

A "New" Sign for the Recognition of Fractures of Cervical and Upper Dorsal Spinous Processes[1]

LT. COL. PETER ZANCA, M.C., U.S.A., and COL. ELMER A. LODMELL, M.C., U.S.A.

SPINOUS PROCESS fractures are most readily seen on the lateral view. On the anteroposterior view they are recognized only with difficulty, unless especially sought.

The radiographic diagnosis of fractures of the spinous processes of the seventh cervical and the first thoracic vertebra can be made on the preliminary anteroposterior view of the cervical and upper thoracic spine. The fracture can be identified by the malalignment and downward displacement of the outer end of the spinous process. On the x-ray film, a double shadow is seen. A smooth, crescentic area of decreased density represents the fractured base of the spinous process, and a denser shadow lying in the soft tissues, slightly caudad to the base of the spinous process, represents the displaced tip.

Patients who have received a severe head or neck injury usually report to the hospital with the head held either in hyperflexion or hyperextension. On the routine lateral view of the neck it is difficult to see the spinous processes of C-7 and T-1 because of the superimposition of the shadows produced by the bone and soft tissues of the shoulder girdle. Under such circumstances, the anteroposterior view of the spine should be sufficient to make a diagnosis of fracture.

During the past twelve months this x-ray sign of fracture of the spinous processes of the lower cervical and upper thoracic vertebrae has been observed in three cases. In two of these the diagnosis of fracture of the spinous process of C-7 was made on the preliminary anteroposterior view. In the third case, here reported, the fracture involved the spinous process of T-1.

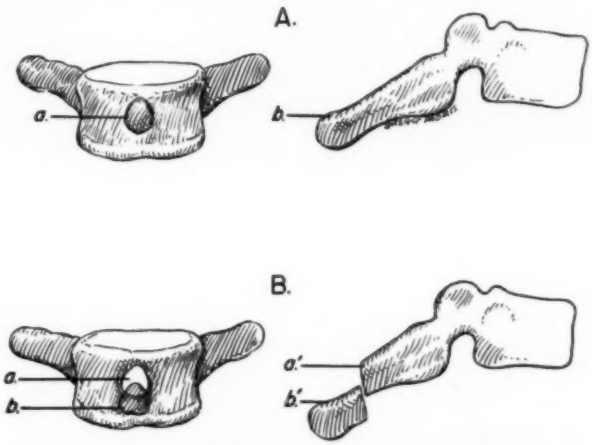

Fig. 1. A. Sketch demonstrating the normal relationship of the spinous process of T-1 when seen on anteroposterior and lateral views.
B. Sketch demonstrating the downward displacement of the outer end of the fractured spinous process of T-1 when seen in anteroposterior and lateral views.

[1] From the Radiological Service, Letterman Army Hospital, San Francisco, Calif. Accepted for publication in August 1950.

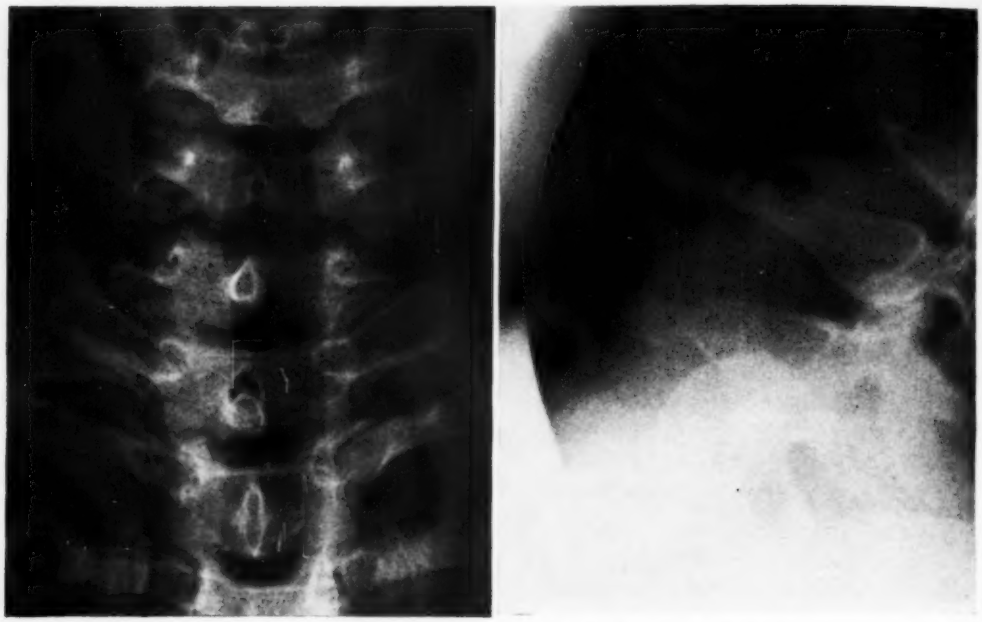

Fig. 2. Anteroposterior view of the upper thoracic spine showing fracture of the spinous process of T-1.
Fig. 3 Lateral view taken in hyperflexion, confirming diagnosis made on the anteroposterior view.

The films of more than two hundred spines have been reviewed, and the sign was recognized only in those cases in which a fracture was present. The identification of the fracture on the preliminary anteroposterior film can serve as a guide and warning that other components of the cervical or thoracic vertebrae may be fractured.

The following case illustrates the ease with which one can identify a fracture of the spinous process of the upper thoracic vertebra on the routine anteroposterior view.

An 18-year old white male was admitted to the hospital because of severe pain in the posterior neck region. There was a history of a direct blow to the neck. Preliminary anteroposterior and lateral views of the neck and upper dorsal spine were taken on admission. On the anteroposterior view a fracture of the spinous process of T-1 with caudad displacement of the outer fragment was seen. A crescentic radiolucent area, representing the base of the spinous process, and a denser shadow of bone seen slightly caudad to the translucent area, representing the fractured tip of the spinous process, were seen. It was difficult to visualize the spinous process of T-1 on the routine lateral view. Later, with more relaxation of the muscles of the neck, and with the neck hyperflexed, a second lateral view was taken. On this film the fracture was clearly visible, confirming the diagnosis previously made.

SUMMARY

1. A new radiographic sign for the identification of fractures of the spinous processes of the lower cervical and upper thoracic vertebrae is described.

2. The identification of the fracture on the preliminary anteroposterior view can serve as warning that other components of the vertebrae may be fractured.

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SUMARIO

Fractura de las Apófisis Espinosas. "Nuevo" Signo para el Reconocimiento de las Fracturas de las Apófisis Espinosas Cervicales y Dorsales Superiores

El nuevo signo radiográfico descrito está destinado a la identificación de las fracturas de las apófisis espinosas de las vértebras cervicales bajas y dorsales superiores en la vista antero-posterior. Toma la forma de una sombra doble: una zona semilunar lisa de menor condensación, que representa la base de la apófisis espinosa, y una sombra más espesa en los tejidos blandos, ligeramente hacia la base de la apófisis, representando el extremo desplazado. La identificación de la fractura en la radiografía antero-posterior preliminar puede servir de aviso de que quizás estén fracturados otros componentes de las vértebras.

EDITORIAL

Medical Freedom, An Individual Responsibility

At the opening session of the Thirty-sixth Annual Meeting of the Radiological Society of North America, Dr. Furey in his Presidential Address, published elsewhere in this issue,[1] posed the question, "How can we [radiologists] do our bit in the campaign for medicine?" and replied: "The answer lies in continuing our effort to solve our own problems and the problems of medicine as a whole—not only in our personal interest but in the interest of all physicians, our patients, and theirs."

But while the problems discussed by Dr. Furey are the problems of medicine—and radiology—as a whole, they are more specifically the problems of every individual physician and, by that token, of every individual radiologist. With each of us rests the responsibility of combating encroachment upon the free, undominated practice of medicine, an encroachment that would destroy the quality of medical and radiological service to the public.

In his Presidential Address before the Southern Medical Association in November 1950, aptly entitled "Weighed in the Balance," Dr. Hamilton W. McKay[2] looks with a critical eye at the medical profession today and makes some pertinent suggestions as to the steps to be taken to meet the present crisis. With the permission of Dr. McKay and of the Southern Medical Association, we are reprinting here parts of this penetrating analysis.

> We know that it is true that more people get better medical care today in America than in any other country in the world. We know that we have a program of medical education second to none. We know that we have a system of hospitals, clinics, and medical centers, small and large, that is the envy of the whole world. All of these and many more are measurable facts that stand above dispute.
>
> But the trouble with most of us is that we stop our thinking at this point. We do not realize that it is not enough to be better than somebody else. Most of the American people do not know much about the levels of medical care and attention in other parts of the world, and most of them care less. We may think our fellow citizens are ungrateful in this, but no matter how much we think it, we still cannot change the fact that they are weighing us in an altogether different set of balances.
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> We are being weighed against the balance of strictly American standards. Our public relations are being weighed against the public relations standards which Americans have come to respect in other pursuits. Our competence is being weighed against the American standard of competence in other professions. Our charges are being weighed against the budgetary demands of other services which are essential to life and happiness in America. What we need is a revolutionary change of direction in our own thinking. We must break from our traditional defensiveness, our backward glances at the distance we have come, our comparisons with Europe and Asia. We must accept the challenge of the American mind. We must weigh ourselves against the standards of American demands!...
>
> I believe, if I am correct in my premise, that there is something radically wrong between the people and the doctors.

Three areas are suggested by Dr. McKay in which immediate beginnings should be made toward improving the situation that exists today. These are, in brief: (1) education of the medical student not alone in the scientific aspects of his profession but in the art of human relations, that he may become a part of the community to which he belongs, one of the people whom he serves; (2) professional self discipline, as exemplified by the grievance committees set up by the profession itself, now operating in more than twenty states; (3) modernization of the medical practice acts which in many states permit doctors to carry out procedures, operative or other-

[1] Page 321.
[2] South. M. J. **44:** 1–4, 1951.

wise, for which they are neither trained nor competent. Dr. McKay concludes:

These suggestions by no means exhaust the possibilities for progressive action. But they do serve most capably the primary purpose of this discussion, which is to make it as clear as I possibly can that ultimate responsibility for the freedom and welfare of American medicine rests squarely upon the individual doctor and his friends in related organizations in the field of general medicine. The term "organized medicine" has no meaning except as it be defined in terms of individual responsibility. Unless and until the doctor on Main Street faces up to the deficiencies of his profession and wants these weaknesses corrected, there will be no progress.

We can win the fight for medical freedom if and when we decide to look after our own business. This means sacrifice, hard work and devotion to organized medicine. Above all else, it means that liberty is possessed only by those who earn the right to be free and employ that freedom in such a fashion as to maintain and enhance the respect and confidence in which the physician is held by his community.

International Recommendations on Radiological Protection

Revised by the International Commission on Radiological Protection at the Sixth International Congress of Radiology, London, July 1950

INTRODUCTION

DEVELOPMENTS in nuclear physics and their practical applications since the last International Congress have greatly increased the number and scope of potential hazards. At the same time biological research has led to an extension of our knowledge of the dangers associated with ionizing radiations. This increase of biological knowledge has not only brought a realization of the importance of certain effects, particularly carcinogenic and genetic effects, but has also provided more information as to the permissible levels of radiation. The International Commission on Radiological Protection has therefore adopted new radiation safety standards with more rigid criteria. Such standards must, in view of the still limited experience of the effects of radiation, be kept continually under review.

It appears that the effects to be considered are:

(1) Superficial injuries.
(2) General effects on the body, particularly the blood and blood forming organs, *e.g.*, production of anemia and leukemias.
(3) The induction of malignant tumors.
(4) Other deleterious effects including cataract, obesity, impaired fertility, and reduction of life span.
(5) Genetic effects.

While it is still fundamental to express whole body exposure in terms of a single number, it is not practicable, in general, in view of the complexity of circumstances now arising, to express the maximum permissible hazards in terms of a single parameter. It is, for example, highly desirable to derive values of maximum permissible concentrations of radioactive materials, in the air or in drinking water, taking into account the metabolism of the materials concerned, and assuming standard anatomical, physiological, and chemical data. Furthermore, the previously accepted value of 1 r per week for maximum permissible exposure to external radiation itself needs revision in the light of the nature of the radiations to which workers are now exposed. There is the added difficulty that the roentgen is not an acceptable unit of dose for all ionizing radiations. Accordingly the following recommendations are based on considerations of the equivalent energy absorbed in tissue coupled with the appropriate relative biological efficiency.

While the values proposed for maximum permissible exposures are such as to involve a risk which is small compared to the other hazards of life, nevertheless in view of the unsatisfactory nature of much of the evidence on which our judgments must be based, coupled with the knowledge that certain radiation effects are irreversible and cumulative, it is strongly recommended that every effort be made to reduce exposures to all types of ionizing radiations to the lowest possible level.

EXPOSURE TO EXTERNAL RADIATION

1. *Exposure of Individuals to X, Gamma, and Beta Radiation.* (*a*) *Whole Body Exposure:* A careful consideration of the deleterious biological effects enumerated in the Introduction, in the light of observations on man and of the experimental data on animals, has led to the conclusion that, in so far as the well-being of the individual is concerned, the most dangerous effects of external radiation are probably those on the blood-forming organs. Although the dose to these organs is regarded as a fundamental quantity, for practical reasons the maximum permissible exposure is best stated in terms of the surface dose per week. The figure of 1 r per week previously adopted by the International X-ray and Radium Protection Commission seems very close to the probable threshold for adverse effects, particularly for radiations of high energy which are

more frequently encountered than formerly. A reduction of surface dose is therefore called for. For these reasons and for those previously outlined in the Introduction, it is recommended that:

(i) *In circumstances under which the whole body may be exposed over an indefinite period to x or gamma radiation of quantum energy less than 3 Mev, the maximum permissible dose received by the surface of the body shall be 0.5 r in any one week. This dose corresponds to 0.3 r per week measured in free air.*

(ii) *In the case of high-energy beta rays, the maximum permissible exposure of the surface of the body in any one week shall be the energy flux of beta radiation such that the absorption per gram of superficial tissues is equivalent to the energy absorption from 1.5 r of hard gamma rays.*

For purposes of calculation, the superficial tissues concerned shall be assumed to be the basal layer of the epidermis, defined conventionally as lying at a depth corresponding to 7 mg./cm.².

(*b*) *Critical Tissues:* The recommendations relating to exposure to external radiation are primarily framed in relation to exposure of the whole body. Nevertheless, a greater exposure should not be permitted for irradiation confined to a particular organ or tissue, except in the case of the hands and forearms. Measurements may be made either in air or at the surface of the body with backscatter, and it is estimated that the surface dose of 0.5 r of penetrating electromagnetic radiation would correspond roughly to 0.3 r at the critical tissue, namely, the blood-forming organs, conventionally assumed to lie at a depth of 5 cm. below the surface. This figure of 0.3 r is the fundamental figure which is thought appropriate for the irradiation of any critical tissue, with the one obvious exception of the skin.

(*c*) *Partial Exposure:* It is recommended that:

In the case of exposure of the hands and forearms to X, gamma, and beta radiation, the maximum permissible dose shall be 1.5 r (or its energy equivalent) in any one week at the basal layer of the epidermis, defined conventionally as lying at a depth corresponding to 7 mg./cm.².

2. *Whole Body Exposure of Individuals to Neutrons.* The International Commission on Radiological Protection considers that the maximum permissible energy absorption per gram of tissues exposed to fast neutrons should not be greater than one-tenth of that permitted for high energy quantum radiation. The Commission is presently in the process of collecting data as a basis for future numerical recommendations.

EXPOSURE TO INTERNAL RADIATION

3. While the Commission does not, at the moment, consider that there is sufficient information to make firm recommendations concerning maximum permissible exposures to internal radiation from radioactive isotopes, it brings to the notice of users of radioactive isotopes values which are commonly used, at the present time, in the United States of America, Canada, and Great Britain. These values will appear in a supplementary document to be prepared and circulated by the Commission.

The Commission will continually review these values as new information becomes available, and will, if necessary, circulate amended values.

I. WORKING CONDITIONS

4. The following conditions are recommended for radiation workers:

(*a*) The amount of radiation received by operators should be systematically checked to insure that the maximum permissible dose is not exceeded. For this purpose, photographic films or small ionization condensers should be carried on the person.

(*b*) In addition, radiation workers should be systematically submitted, both on entry and subsequently, to expert blood examinations every three months, and to medical and general examinations once a year, special attention being paid to the hands. These examinations will determine the acceptance, refusal, limitation, or termination of occupation involving radiation exposure.

II. GENERAL X-RAY AND RADIUM RECOMMENDATIONS

5. All rooms should be provided with adequate ventilation. In certain climates it may be necessary to have recourse to air conditioning. For rooms of normal dimensions, say 3,000 cu. ft. (90 m.³), in which corona-free apparatus is installed, the ventilating system should be capable of renewing the air of the room not less than six times per hour, while up to ten times may be required when the apparatus is not corona-free. Large rooms require proportionately fewer changes of air per hour than small ones. Air inlets and outlets should be arranged to afford cross-wise ventilation of the room.

6. All rooms should preferably be decorated in light colors.

7. A working temperature of about 18–22° C. (65–72° F.) is desirable in x-ray rooms.

8. X-ray rooms should be large enough to permit a convenient layout of the equipment. A minimum floor area of 250 sq. ft. (25 m.²) is recommended for x-ray rooms, and 100 sq. ft. (10 m.²) for darkrooms. Ceilings should be not less than 11 ft. (3.5 meters) high.

9. High-tension generators having exposed high-tension systems should preferably be placed in a separate room from the x-ray tube.

III. X-RAY PROTECTIVE RECOMMENDATIONS

10. An x-ray operator should on no account expose himself to a direct beam of x-rays.

11. An operator should place himself as remote as practicable from the x-ray tube. It should be borne in mind that valve tubes are capable of producing x-rays.

12. The x-ray tube should be self-protected, or otherwise surrounded as completely as possible with protective material of adequate lead equivalent.

13. Barriers of protective material against primary and secondary radiation should be erected and should be of sufficient thickness to reduce the radiation level at any point of occupancy to the permissible levels stated above.

(*A*) *Diagnostic Work*

14. In the case of diagnostic work with other than completely protected tubes, the operator should be afforded additional protection from stray radiation by a screen of a minimum lead equivalent of 1 millimeter.

15. Screening examinations should be conducted as rapidly as possible with minimum intensities and apertures, particularly when fractures are reduced under x-rays. Palpation with the hand should be reduced to the minimum.

16. The lead glass of fluorescent screens should be of sufficient thickness to reduce the radiation to the permissible level.

17. In the case of screening stands, the fluorescent screen should, if necessary, be provided with a protective "surround," so that adequate protection against direct radiation is afforded for all positions of the screen and diaphragm.

18. Screen stands and couches should provide adequate arrangements for protecting the operator against scattered radiation from the patient.

19. Protective gloves, which should be suitably lined with fabric or other material, should have a protective value not less than 1/3 millimeter lead throughout both back and front (including fingers and wrist). Protective aprons should have a minimum lead value of 1/2 millimeter.

(*B*) *Treatment*

20. In the case of x-ray treatment, the operator is best stationed completely outside the x-ray room behind a protective wall, the lead equivalent of which will depend on the circumstances. In the case of a single x-ray tube excited by voltages up to 200 kv., the protective wall should have a minimum lead equivalent of 2 millimeters. This figure should be increased in the case of higher exciting voltages or of heavy tube-currents so as to reduce the radiation at any point of occupancy to the agreed permissible level. In such event the remaining walls, floor, and ceiling may also be required to provide supplementary protection for adjacent occupants to an extent depending on the circumstances. Full protection should be provided in all those directions in which the direct beam can operate. Inspection windows in screens and walls should have protective lead values equivalent to that of the surrounding screen or wall.

21. In those cases in which an x-ray tube is continuously excited, and treatment periods are regulated by means of a shutter, some form of remote control should be provided for the shutter, to insure that the operator is not exposed to direct radiation while manipulating the shutter or filter.

22. Efficient safeguards should be adopted to avoid the omission of a metal filter in x-ray treatment, for example, by an interlocking device or by continuously measuring the emergent radiation. Protective screens and applicators (cones) used in treatment to define the ports of entry of x-ray beams should be sufficiently thick to reduce the dosage-rate outside the direct field of irradiation to less than 2 per cent that of the direct beam.

IV. ELECTRICAL PRECAUTIONS IN X-RAY ROOMS

23. Floor-covering of x-ray rooms should be of insulating material, as wood, rubber, or linoleum.

24. Where permanent overhead conductors are employed, they should be not less than 9 ft. (3 m.) from the floor. They should consist of stout metal tubing or other coronaless type of conductor. The associated connecting leads should be of coronaless wire kept taut by suitable rheophores.

25. Wherever possible, earthed guards or earthed sheaths should be provided to shield the more adjacent parts of the high-tension system. Unshielded leads to the x-ray tube should be in positions as remote as possible from the operator and the patient. The use of "shockproof" x-ray equipment, in which the high-tension circuit is completely enclosed in earthed conductors, is recommended. In all cases, however, indiscriminate handling of x-ray tubes during operation should be forbidden. Unless there are reasons to the contrary, metal parts of the apparatus and room should be efficiently earthed.

26. Main and supply switches should be very accessible and distinctly indicated. They should not be in the proximity of the high-tension system, nor should it be possible for them to close accidentally. The use of quick-acting, double-pole circuit breakers is recommended. Over-powered fuses should not be used. If more than one apparatus is operated from a common generator, suitable high-tension, multi-way switches should be provided. In the case of some of the constant-potential generators, a residual charge is held by the condensers after shutting down, and a suitable discharging device should therefore be fitted. Illuminated warning devices which operate when the equipment is "alive" serve a useful purpose. The staff should be trained in the use of first-aid instructions dealing with electrical shock. If foot switches are used, they should be connected in series with an ordinary switch, and should be so designed that they cannot be locked to keep the circuit "alive," and are not capable of being closed accidentally.

27. Some suitable form of kilovoltmeter should be provided to afford a measure of the voltage operating the x-ray tube.

28. Low flash-point anaesthetics should never be used in conjunction with x-rays.

V. FILM STORAGE PRECAUTIONS

29. The use of non-inflammable x-ray films is strongly recommended. In the case of inflammable films, suitable precautions should be taken as regards their use and storage. Large stocks should be kept in isolated stores, preferably in a separate building or on the roof.

VI. RADIUM PROTECTIVE RECOMMENDATIONS

(*A*) *Radium Salts*

30. Protection for radium workers is required from the effects of:

(*a*) Beta rays upon the hands.

(*b*) Gamma rays upon the internal organs, vascular and reproductive systems.

31. In order to protect the hands from beta rays, reliance should be placed, in the first place, on distance. The radium should be manipulated with long-handled forceps, and should be carried from place to place in long-handled boxes, lined on all sides with at least 1 cm. of lead. All manipulations should be carried out as rapidly as possible.

32. Radium, when not in use, should be stored in a safe as distant as possible from the personnel. It is recommended that the safe should be provided with a number of separate drawers individually protected. In the table below will be found the thicknesses of lead which will reduce the radiation to permissible levels at various distances from the source.

33. A separate room should be provided for the "make-up" of screened tubes and applicators, and this room should only be occupied during such work.

34. In order to protect the body from the penetrating gamma rays during handling of radium, a screen of not less than 2.5 cm. of lead should be used, and proximity to the radium should only occur during actual work, and for as short a time as possible.

35. The measurement room should be a separate room, and it should preferably contain the radium only during its actual measurement.

36. Nurses and attendants should not remain in the same room as patients undergoing radium treatment with quantities exceeding 1/2 gram.

37. All unskilled work, or work which can be learned in a short period of time, should preferably be carried out by temporary workers, who should be engaged on such work for periods not exceeding six months. This applies especially to nurses and those engaged in "making-up" applicators.

38. Radium containers should be tested periodically for leakage of radon. Prejudicial quantities of radon may otherwise accumulate in radium safes, etc., containing a number of leaky containers.

39. Information regarding the quantity of radium and type of transport container, which will be accepted for transmission by land, sea, or air, should be obtained from the appropriate Transport Authorities in the individual countries.

(*B*) *Radon*

40. In the manipulation of radon, protection against beta and gamma rays is required, and automatic or remote controls are desirable.

41. The handling of radon should be carried out, as far as possible, during its relatively inactive state.

42. Precautions should be taken against excessive gas pressures in radon plants. The escape of radon should be very carefully guarded against, and the room in which it is prepared should be provided with an exhaust fan controlled from outside the room.

43. Where radon is likely to come in direct contact with the fingers, thin rubber gloves should be worn to avoid contamination of the hands with active deposit. Otherwise the protective measures recommended for radium salts should be carried out.

44. The pumping room should preferably be contained in a separate building. The room should be provided with a connecting tube from the special room in which the radium is stored in solution. The radium in solution should be heavily screened to protect people working in adjacent rooms. This is preferably done by placing the radium solution in a lead-lined box, the thickness of lead recommended being according to the table below [opposite page].

(*C*) *Radium-Beam Therapy*

45. The risks to the operator attendant on the use of large quantities of radium in radium-beam therapy may be largely obviated if some system of remote control is adopted by which the radium is only introduced into the "bomb" after the latter has been adjusted in position on the patient. If such arrangements are not available, the importance of expeditious handling is stressed.

46. Rooms used for radium-beam therapy should provide adequate protection for adjacent wards and rooms in permanent occupancy.

In the following table [opposite page] are given the lead thicknesses required to ensure that the maximum permissible level is not exceeded.

Data may very conveniently be represented in a nomograph showing amounts of radiation through lead barriers at different distances from the source.

RECOMMENDATIONS FOR INTERNATIONAL SUBCOMMITTEES ON RADIATION PROTECTION AND FOR CORRESPONDING NATIONAL COMMITTEES AND SUBCOMMITTEES

1. In order to facilitate the work of the International Commission on Radiological Protection, which has become so arduous that a single small committee cannot compass the whole field, it is proposed to establish a number of subcommittees to carry out detailed studies in specialized fields between the Congresses. The chairmen of these subcommittees need not necessarily be chosen from the membership of the International Commission on Radiological Protection.

LEAD THICKNESSES TO ENSURE PERMISSIBLE DOSE

Quantity of Radium (0.5 mm. Pt Screen) (gm.)	Thickness of Lead to Give Weekly Maximum Permissible Dose at the Following Distances from the Source				
	20 cm. (cm.)	50 cm. (cm.)	1 meter (cm.)	2 meters (cm.)	5 meters (cm.)
0.1	10.0	6.0	3.5	1.0	0
0.2	11.5	7.5	4.5	2.0	0
0.5	13.5	9.5	6.5	4.0	0.5
1.0	15.5	11.0	8.0	5.0	1.5
2.0	16.0	12.5	9.5	6.5	3.0
5.0	18.0	14.5	11.5	8.5	4.5
10.0	19.5	16.0	13.0	10.0	6.0

The subcommittees suggested are as follows:

(1) Permissible dose for external radiation.
(2) Permissible dose for internal radiation.
(3) Protection against x-rays generated at potentials up to 2 million volts.
(4) Protection against x-rays above 2 million volts, and gamma rays and beta rays.
(5) Protection against heavy particles, including neutrons and protons.
(6) Disposal of radioactive wastes; handling of radioisotopes.

2. It is further proposed that the International Commission on Radiological Protection recommend that all interested countries establish, each for itself, a central national committee to deal with problems of radiation protection, such a central committee to have subcommittees matching those of the International Commission on Radiological Protection as closely as circumstances permit.

3. So far as possible members of the international subcommittees should be selected from the corresponding subcommittees of the various national committees.

4. On matters of policy and formal agreements, communication will be from the central national committee to the International Commission. It is, however, recommended that direct communication on technical matters may be conducted between the corresponding national and international subcommittees.

PROPOSED RULES COVERING THE SELECTION AND WORK OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

1. (*a*) The International Commission on Radiological Protection (I.C.R.P.) shall be composed of not more than twelve members. The selections shall be made by the International Executive Committee (I.E.C.) from a list of nominations submitted by the national delegations and by the International Commission on Radiological Protection itself. Members of the I.C.R.P. shall be chosen on the basis of their recognized activity in the fields of Radiology, Radiation Protection, Physics, Biology, Genetics, Biochemistry, and Biophysics, without regard to nationality.

(*b*) The members of the I.C.R.P. shall be selected during one International Congress to serve through the succeeding Congress. Not less than 2 but not more than 4 members of the I.C.R.P. shall be changed at each Congress. In the intervening period a vacancy caused by conditions beyond the control of the I.E.C. shall be filled on the recommendation of the I.C.R.P.

(*c*) In the event of a member of the I.C.R.P. being unable to attend the I.C.R.P. meetings, a substitute may be selected by the I.C.R.P. as a temporary replacement. Such a substitute member shall not have voting privileges at the meetings unless specifically authorized by the I.E.C.

(*d*) The I.C.R.P. shall be permitted to invite individuals to attend its meetings to give special technical advice. Such persons shall not have voting privileges but may ask permission to have their opinion recorded in the minutes.

2. The continuance of the policies and records of the I.C.R.P. shall be in the hands of a Secretary of the I.C.R.P., elected by the I.C.R.P. from among its regular members and subject to the approval of the I.E.C.

3. The I.C.R.P. shall familiarize itself with progress in the whole field of radiation protection. The Secretary shall be responsible for the preparation of a program to be submitted to the Commission for discussion at its meetings. Preliminary reports shall be prepared and circularized to all members of the I.C.R.P. and other specially qualified individuals at least six months before the meeting of the Congress.

4. The Chairman shall be elected by the I.C.R.P. six months in advance of the Congress. The choice shall not be limited to the members of the I.C.R.P. or to the country in which the Congress is held. Such a Chairman shall be a member of the I.C.R.P. *ex officio*, but for the period of the Conference only. Meetings between Congresses shall be presided over by the Secretary or other member selected by the I.C.R.P.

5. Decisions of the I.C.R.P. shall be decided by a

majority vote, with the Chairman casting the deciding vote in case of a tie. A minority opinion may be appended to the minutes of a meeting if so desired by any member and upon his submission of same in writing to the Secretary.

Members of the International Commission on Radiological Protection Preparing the Above Report.

E. ROCK CARLING, *Chairman*, Great Britain
L. S. TAYLOR, *Acting Secretary*, U. S. A.
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Supplement on Maximum Permissible Amounts of Radioactive Isotopes

The International Commission on Radiological Protection finds that, at present, it is not in a position to make firm recommendations regarding the maximum permissible amounts of radioactive isotopes that may be taken into, or retained in, the body. It is possible, however, on the basis of the general principles set forth in "International Recommendations on Radiological Protection," as revised by I.C.R.P. at the Sixth International Congress of Radiology, July 1950, to make reasonable calculations of the maximum permissible amounts of several of the more important radioactive isotopes.

In the meantime, the I.C.R.P. draws attention to the following data on maximum permissible exposures to radioactive isotopes *for occupational workers*, presently used in the United States, Canada, and the United Kingdom. The radioactive isotopes can enter the body either by inhalation or by ingestion. Accordingly figures are also given for the maximum permissible levels (m. p. l.) of various isotopes in air and in liquid media.

Ra^{226}

Clinical observations on chronic radium poisoning in man indicate that the most serious effects are anemia and damage to bone, including osteogenic sarcoma. Both effects appear to have a threshold of the order of 1 μc. fixed in the skeleton. Accordingly it is accepted that:

(*a*) *The maximum permissible amount of radium fixed in the body is 0.1 μc.*

(*b*) *For radium appearing in the atmosphere as a soluble aerosol, assuming that 25% of the inhaled amount is absorbed and that 25% of the absorbed amount is retained with a mean life of about 10^4 days, the maximum concentration in air for soluble compounds is 8×10^{-12} μc./c.c.*

(*c*) *If radium enters the body through liquid media, assuming 10% of the ingested amount is retained with a mean life of about 10^4 days, the maximum permissible concentration of the liquid is 4×10^{-8} μc./c.c.*

Pu^{239}

On the basis of the relative biological effects of plutonium and radium, as observed in animal experiments, it is accepted that:

(*a*) *The maximum permissible amount of Pu^{239} fixed in the body is 0.04 μc.*

For soluble compounds of plutonium in the atmosphere, it is estimated that 10% of the inhaled material is absorbed, with a mean life of 10^4 days. The maximum permissible concentration in air is, therefore, 2×10^{-12} μc./c.c.

For insoluble compounds, it is estimated that the mean life in the lung is 200 days. If the irradiation of the lungs by alpha rays were limited to the biological equivalent of 0.3 r per week, the corresponding concentration of the plutonium in air would be 7.5×10^{-12} μc./c.c. In view of the possibility of the transference of some of the insoluble material from the lungs to the skeleton, it is suggested that:

(*b*) The maximum permissible concentration of Pu^{239} in air is 2×10^{-12} μc./c.c., for soluble and insoluble compounds.

(*c*) For Pu^{239} in liquid media, assuming that 0.1% of the ingested amount is retained in the skeleton with a mean life of 10^4 days, the maximum permissible concentration is 1.5×10^{-6} μc./c.c.

Sr^{89} AND Sr^{90} ($+Y^{90}$)

On the basis of the observed relative biologica effects of Sr^{89} and Ra on animals, it is accepted that:

(*a*) *The maximum permissible amount of Sr^{89} in the body is 2.0 μc.*

Since the combined disintegration energy of the $Sr^{90} + Y^{90}$ pair is twice that of Sr^{89}, the maximum amount of Sr^{90} which can be permitted in the body is only one-half that of Sr^{89}. Accordingly

(*b*) *The maximum permissible amount of Sr^{90} in the body is 1.0 μc.*

If strontium is assumed to behave like radium as regards uptake, then

(*c*) *For Sr^{90} in air, assuming that 25% of the inhaled amount is absorbed and 25% of the absorbed amount is retained with a mean life of about 15 years, the maximum permissible concentration is 2×10^{-10} μc./c.c.*

(*d*) *For Sr^{90} in liquid media, assuming 10% of the ingested amount is retained with a mean life of about 15 years the maximum permissible concentration is 8×10^{-7} μc./c.c.*

NATURAL URANIUM

As the specific activity of natural uranium is so low, it is considered that the hazards arising from its use are mainly chemical.

Po^{210}

Although polonium is not a bone-seeking isotope, some data exist on its toxicity relative to radium in animals. On this basis, it is accepted that:

The maximum permissible amount of Po^{210} in the body is 0.005 μc.

H^3

It is assumed that tritium will be encountered in chemical forms in which free exchange takes place with ordinary hydrogen in the aqueous vapor in the lungs. If the mean energy of the beta radiation is 5.5 kv., a concentration of 0.14 μc. per gram of tissue will result in the biological equivalent of 0.3 r per week. The mean life of H^3 in the body is taken to be 10 days. A concentration of 0.14 μc./gram of tissue corresponds to 10 mc. uniformly distributed in the 70 kg. of the Standard Man. It is, therefore, accepted that:

(*a*) *The maximum permissible amount of H^3 in the body is 10 mc.*

(*b*) *The maximum concentration of H^3 in air, based on a permissible daily intake of 1 mc. and complete absorption in the lungs, is 5×10^{-5} μc./c.c.*

(*c*) *The maximum concentration of H^3 in liquid media, based on a permissible daily intake of 1 mc., and complete absorption in the body, is 0.4 μc./c.c.*

C^{14} (as CO_2 in Air)

A rate of energy absorption biologically equivalent to 0.3 r per week would be produced by 0.014 μc. of C^{14} per gram of tissue. If the highest proportion of carbon in any tissue is 50%, then the maximum permissible concentration of C^{14} in carbon in the body is 0.028 μc. per gram of carbon. The postulated route of entry of C^{14} into the body is *via* the alveoli of the lungs, and the isotopic concentration in the alveolar air must therefore be limited to 0.028 μc. per gram of carbon. Since alveolar air contains 5.5% by volume of carbon dioxide, the maximum permissible concentration of C^{14} in the CO_2 of the alveolar air is about 1×10^{-6} μc./c.c.

Accordingly:

The maximum permissible concentration of C^{14} as carbon dioxide in air is 1×10^{-6} μc./c.c.

Na^{24}

The energy (beta and gamma) absorbed in the body per disintegration of Na^{24} is estimated to be 2.7 Mev. Since sodium is uniformly distributed throughout the body:

(*a*) The maximum permissible amount of Na^{24} in the body, corresponding to a dose rate biologically equivalent to 0.3 r per week, is 15 μc.

Since biological excretion may be neglected in comparison to the radioactive decay, for which the mean life is 0.8 day:

(*b*) *For Na^{24} in liquid media, the maximum permissible concentration, assuming complete absorption, is 8×10^{-3} μc./c.c.*

P^{32}

Experimental and clinical data in man show that at times of the order of the mean life of P^{32}, *i.e.*, about 20 days, the concentration of P^{32} in red bone marrow reaches a value only about three times the average concentration for the whole body. As most of the P^{32} is still diffused throughout the body, a dose rate biologically equivalent to 0.3 r per week in the critical tissue (red bone marrow) is therefore produced by a total quantity of approximately 25 μc. of P^{32} in the whole body. In order to allow for the possible occurrence of higher local concentrations in bone marrow:

(*a*) *The maximum permissible amount of P^{32} in the body is 10 μc.*

(*b*) *The maximum permissible concentration of P^{32} in liquid media, assuming that 100% is absorbed and that the biological excretion can be neglected in comparison to the radioactive decay, is 2×10^{-4} μc./c.c.*

Co^{60}

Making the assumption that all the cobalt which is absorbed is deposited in the liver and that the effective energy in the liver is 1.3 Mev per disintegration, the amount of Co^{60} to give a dose rate biologically equivalent to 0.3 r per week is 1 μc. It is therefore accepted that:

(*a*) *The maximum permissible amount of Co^{60} in the body is 1 μc.*

(*b*) *The maximum permissible concentration of Co^{60} in liquid media, assuming 100% absorption and a half life in the liver of 20 days, is 1×10^{-5} μc./c.c.*

I^{131}

The energy absorbed in the thyroid gland per disintegration of I^{131} is estimated to be 0.27 Mev, and so the amount of I^{131} in the gland to give a dose rate biologically equivalent to 0.3 r per week is 0.18 μc., which would correspond to about 0.3 μc. in the body. It is therefore accepted that:

(*a*) *The maximum permissible amount of I^{131} in the body is 0.3 μc.*

(*b*) *The maximum permissible concentration of I^{131} in air, assuming that 100% is absorbed, that 20% of the absorbed amount is deposited in the thyroid, and that biological excretion from the gland can be neglected in comparison to radioactive decay, is 3×10^{-9} μc./c.c.*

(*c*) *The maximum permissible concentration of I^{131} in liquid media, assuming that 100% is absorbed, that 20% of the absorbed amount is deposited in the thyroid gland, and that biological excretion from the gland can be neglected in comparison to radioactive decay, is 3×10^{-5} μc./c.c.*

All the preceding permissible amounts of isotopes refer to occupational exposure and are summarized in the table [on following page]

PERMISSIBLE AMOUNTS OF ISOTOPES, OCCUPATIONAL EXPOSURE

	Ra^{226}	Pu^{239}	Sr^{89}	$Sr^{90}(+Y^{90})$	Po^{210}	H^3	C^{14}(as CO_2 in Air)	Na^{24}	P^{32}	Co^{60}	I^{131}
Maximum permissible level (m. p. l.) in body (μc.)	0.1	0.04	2.0	1.0	0.005	1×10^{4}	....	15	10	1	0.3 (0.18 in thyroid)
Effective mean life (days)	10^{4}	10^{4}	...	5,000	...	10	...	0.8	20	20	12
Permissible daily deposition in body (μc.)	10^{-5}	4×10^{-6}	...	2×10^{-4}	...	1×10^{3}	....	20	0.5	0.05	0.015 (to thyroid)
Proportion absorbed *via* lungs and retained in body	0.06	0.1	...	0.06	...	1	....	....	....	....	0.2 (to thyroid)
M.p.l. in air (μc./c.c.)	8×10^{-12}	2×10^{-12}	...	2×10^{-10}	...	5×10^{-5}	1×10^{-6}	....	....	....	3×10^{-9}
Proportion retained from gut	0.1	0.001	...	0.1	...	1	....	1	1	1	0.2
M.p.l. in liquid media (μc./c.c.)	4×10^{-8}	1.5×10^{-6}	...	8×10^{-7}	...	0.4	....	8×10^{-3}	2×10^{-4}	1×10^{-4}	3×10^{-5}

Appendix I: Standard Man

(A) MASS OF ORGANS

Organs	Grams
Muscles	30,000
Skeleton	
Bones	7,000
Red marrow	1,500
Yellow marrow	1,500
Blood	5,000
Gastro-intestinal tract	2,000
Lungs	1,000
Liver	1,700
Kidney	300
Spleen	150
Pancreas	70
Thyroid	20
Testes	40
Heart	300
Lymphoid tissue	700
Brain	1,500
Spinal cord	30
Bladder	150
Salivary glands	50
Eyes	30
Teeth	20
Prostate	20
Adrenals	20
Thymus	10
Skin and subcutaneous tissues	8,500
Other tissues and organs not separately defined	8,390
TOTAL BODY WEIGHT	70,000

(B) CHEMICAL COMPOSITION

Element	Proportion (Per Cent)	Approximate Mass in Grams in the Body
Oxygen	65.0	45,500
Carbon	18.0	12,600
Hydrogen	10.0	7,000
Nitrogen	3.0	2,100
Calcium	1.5	1,050
Phosphorus	1.0	700
Potassium	0.35	245
Sulfur	0.25	175
Sodium	0.15	105
Chlorine	0.15	105
Magnesium	0.05	35
Iron	0.004	3
Manganese	0.0003	0.2
Copper	0.0002	0.1
Iodine	0.00004	0.03

The figures for a given organ may differ considerably from these averages for the whole body. For example, the nitrogen content of the dividing cells of the basal layer of skin is probably nearer 6% than 3%.

(C) APPLIED PHYSIOLOGY

(Average data for normal activity in a temperate zone)

(i) *Water balance*

Daily water intake (2.5 liters)

In food (including water of oxidation)	1.0 liter
As fluids	1.5 liter

Calculations of maximum permissible levels for radioactive isotopes in water have been based on the total intake figure of 2.5 liters per day.

Daily water output (2.5 liters)	
Sweat	0.5 liter
From lungs	0.4 liter
In feces	0.1 liter
Urine	1.5 liter
Total water content of body	50 liters

(iii) *Retention of particulate matter in the lungs*

In those cases where specific data are lacking, the convention has been adopted that 50 per cent of any aerosol reaches the alveoli of the lungs. If the particles are soluble, they have been considered to be completely absorbed; if insoluble, then the 50% amount has been regarded as retained for 24 hours, after which only half of it, *i.e.*, 25% of the inhaled amount, is retained *in situ* indefinitely.

RESPIRATORY EXCHANGE

Physical Activity	Hours per Day	Tidal Air (Liter)	Resp. per Minute	Volume per 8 Hours (M^3)	Volume per Day (M^3)
At work	8	1.0	20	10	20
Not at work	16	0.5	20	5	

(ii) *Respiration*

Area of respiratory tract	
Respiratory interchange area	50 m^2
Non-respiratory area (upper tract and trachea to bronchioles)	20 m^2
Total	70 m_2
Carbon dioxide content (by volume) of air	
Inhaled air (dry, at sea level)	0.03%
Alveolar air	5.5%
Exhaled air	4.0%

(D) DURATION OF EXPOSURE

(i) *Duration of occupational exposure:* The following figures have been adopted in calculations pertaining to occupational exposure:

8 hours per day
40 hours per week
50 weeks per year

(ii) *Duration of "lifetime" for non-occupational exposure:* A conventional figure of 70 years has been adopted.

Appendix II: Relative Biological Efficiency

The relative biological efficiency of any given radiation has been defined by comparison with the gamma radiation from radium filtered by 0.5 mm. of platinum. It has been expressed numerically as the inverse of the ratio of the dose of the two radiations (in ergs per gram of tissue) required to produce the same biological effect under the same conditions. It has been assumed, for purposes of calculation, that the relative biological efficiency of a given radiation is the same for all effects mentioned in the Introduction, with the single exception of gene mutations.

The effective figure for slow neutrons should be derived in any given case from an evaluation of the separate contributions to the biological effect by protons arising from the disintegration of the nitrogen nuclei and by gamma rays arising from the capture of neutrons by hydrogen nuclei.

The following values have been adopted:

Radiation	Relative Biological Efficiency
Gamma rays from radium (filtered by 0.5 mm. Pt); X-rays of energy 0.1 to 3.0 Mev; Beta rays	1.0
Protons	10
Fast neutrons of energy not greater than 20 Mev	10
Alpha rays	20

GREATER MIAMI RADIOLOGICAL SOCIETY

At a recent meeting of the Greater Miami Radiological Society, Dr. Frazier Payton was elected President, and Dr. Theodore M. Berman, 350 Lincoln Road, Miami Beach, Secretary. The Society meets on the last Wednesday of each month in the Veterans Administration Building, Miami.

HOUSTON RADIOLOGICAL SOCIETY

The Houston Radiological Society, formerly the Houston X-ray Club, has elected the following officers for the ensuing year: Dr. Palmer E. Wigby, President; Dr. Luther M. Vaughan, Vice-President; Dr. Harry Fishbein, Treasurer; Dr. Frank M. Windrow, 1205 Hermann Professional Building, Houston 5, Secretary.

PENNSYLVANIA RADIOLOGICAL SOCIETY

The Thirty-sixth Annual Meeting of the Pennsylvania Radiological Society will be held May 18 and 19, in the William Penn Hotel, Pittsburgh, Penna. The officers of the Society are: President, Edgar C. Baker, M.D.; President-Elect, Maurice F. Goldsmith, M.D.; First Vice-President, Joseph T. Danzer, M.D.; Second Vice-President, D. Alan Sampson, M.D.; Secretary-Treasurer, James M. Converse, M.D., 416 Pine St., Williamsport 8; Editor, Carl B. Lechner, M.D.

NORTH DAKOTA RADIOLOGICAL SOCIETY

A very successful meeting of the North Dakota Radiological Society was held in Fargo, Feb. 3 and 4, with all members in attendance. The newly elected officers are: H. Milton Berg, M.D., of Bismarck, President; Charles Heilman, M.D., of Fargo, Vice-President; Philip H. Woutat, M.D., 322 Demers Ave., Grand Forks, Secretary-Treasurer.

FELLOWSHIPS IN RADIOLOGICAL RESEARCH

The Board of Directors of the James Picker Foundation has announced the award of two fellowships and one grant in radiological research, made on recommendation of the Committee on Radiology of the National Research Council, and administered by the Council.

The fellowship awards were made to Dr. Frederick G. Sherman, Brown University, who will study the effects of ionizing radiations on enzyme activities of microorganisms, at the University of Stockholm under Dr. George Hevesy, and to Dr. Halvor Vermund, University of Minnesota, who will study the effects of roentgen irradiation on incorporation of radiophosphorus into the intracellular constituent of transplanted mouse mammary carcinoma, at that institution with Drs. K. W. Stenstrom, C. P. Barnum, and R. A. Huseby.

The research grant was made to the Zoophysiological Laboratory, University of Copenhagen, Denmark, to enable Dr. Hilde Levi to carry out autoradiographic studies of alpha- and soft beta-emitters in animal tissue.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

PHYSICS IN MEDICAL RADIOLOGY. By SIDNEY RUSS, C.B.E., D.Sc., F. Inst. P., Professor Emeritus, Middlesex Hospital; Fellow of University College, London; L. H. CLARK, Ph.D., F. Inst. P., Physicist, Hammersmith and Lambeth Hospitals, AND S. R. PELC, Ph.D., Physicist, Medical Research Council, Radiotherapeutic Research Unit. Second ed., revised, 1950. A volume of 296 pages, with 106 illustrations. Published by Chapman & Hall, Ltd., London. Price 30s net.

GLI ISOTOPI RADIOATTIVI E LE LORO APPLICAZIONI IN MEDICINA E IN BIOLOGIA. By DOTT. GIOVANNI SCARZMOZZINO, Specialista in radiologia medica e terapia fisica. Istituto di radiologia medica e terapia fisica dell'Università di Pavia. Preface by PROF. ARDUINO RATTI. A volume of 278 pages, with 48 illustrations. Edizioni Scientifiche Italiane, Naples, 1950.

Book Reviews

THE PREPARATION OF PHOTOGRAPHIC PRINTS FOR MEDICAL PUBLICATION. By STANLEY J. McCOMB, F.B.P.A., Section on Photography, Mayo Clinic, Rochester, Minn. Publication No. 90, American Lecture Series, edited by Ralph P. Creer, F.B.P.A. A volume of 69 pages, with 21 figures. Published by Charles C Thomas, Springfield, Ill., 1950. Price $2.00.

There is no question as to the value of good illustrations in the medical literature. A photograph will often show at a glance what it may take a page or more of text to describe. Frequently it will yield information that no words can adequately convey. This places a special responsibility upon all physicians publishing papers to see to it that the illus-

trations which they offer for publication are of the best quality obtainable. Every editor has been faced with the problem of poor prints of assorted shapes and sizes, often marred by irrelevant background details and careless lettering.

Mr. Stanley J. McComb of the Mayo Clinic's Section on Photography has prepared a concise monograph with these very matters in mind. His work makes no pretense at being a complete text on medical photography. His primary purpose is rather to stress the importance of a good photograph and to point out some of the factors to be considered and some of the pitfalls to be avoided in attaining this end. He offers many useful suggestions which, with the aid of his numerous illustrations, should enable the reader to increase the eye-appeal of his own illustrative material. Every contributor or would-be contributor to the medical literature should read this little book in order that he may properly judge the quality of his illustrations whether or not he does the actual photography.

DIE ENTWICKLUNG DER LUNGENTUBERKULOSE IM RÖNTGENBILD. By PROF. DR. ERICH ZDANSKY, Chief, Zentral-Röntgeninstitut am Allgemeinen Krankenhaus in Wien. A monograph of 68 pages, with 70 illustrations. Published by Springer, Wien, 1949. Distributed in the United States by Walter J. Johnson, Inc., New York. Price $3.00.

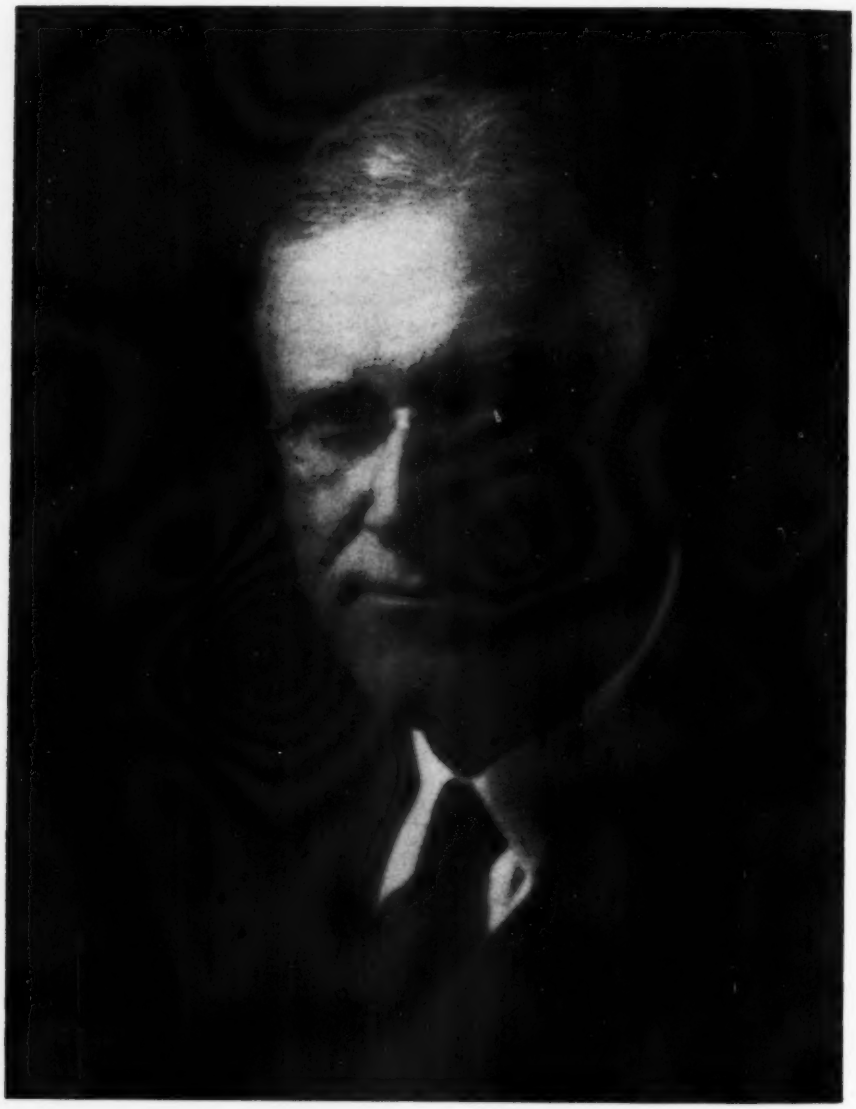
This is a brief yet fairly complete outline of the roentgen diagnosis of pulmonary tuberculosis with emphasis upon the initial infection and its immediate results. While the stated purpose of the author is to present the development of tuberculous lesions as they appear on the x-ray film, the actual presentation is as a series of pictures each representing a pathogenetic entity. Examples of these entities (incorporated in the book under fifteen separate headings) are the primary complex, reactivation of the primary complex, hilar reactivation in the adult, acute miliary tuberculosis, the early latent focus, chronic diffuse tuberculosis, and chronic cavitating tuberculosis. Typical teutonic preciseness characterizes both these descriptions and the preliminary discussion of exudative, productive, and fibroblastic changes.

Zdansky tends to emphasize the development of all stages of tuberculosis from a single initial infection, while playing down any possible role of superinfection. The presentation of differential diagnosis for each particular variant, the discussion of the Assmann body, and the line drawings are meritorious. Essentially the book is a small, didactic primer furnishing a quick diagnostic review.

Special Notice

Radiological Society of North America

At the Thirty-sixth Annual Meeting of The Radiological Society of North America, Inc., the Membership voted to change the By-laws of the Society so that the deadline for accepting applications shall be at least six months prior to the annual meeting. In 1951 the deadline for accepting applications will be June 2, 1951.



FRANCIS CARTER WOOD, M.D.

1869–1951

Francis Carter Wood, a gentleman, a teacher, a scholar, an inspiration, and an unrelenting foe of the charlatans preying on those afflicted with cancer, died on Jan. 5, 1951, in the Englewood Hospital, Englewood, N. J.

Dr. Wood was born in Columbus, Ohio, Dec. 30, 1869. He was graduated from Ohio State University in 1891 and from the College of Physicians and Surgeons, Columbia University, in 1894. He interned at St. Luke's Hospital, New York City, and continued graduate study abroad in Vienna and Berlin until 1897, when he was appointed Pathol-

ogist at St. Luke's. He was an Attending Physician in that hospital from 1909 to 1938 and a Consulting Physician from 1938 until his death. In 1910 he became Director of St. Luke's Pathological Laboratory. He directed the Radiation Therapeutic Department from 1921 and had acted as Consulting Pathologist since 1947.

At the College of Physicians and Surgeons, Columbia University, Dr. Wood served as an assistant in Clinical Pathology from 1896 to 1898, as Instructor from 1898 to 1904, as Adjunct Professor from 1904 to 1906, and as Professor and Director of the Department of Clinical Pathology from 1906 to 1912. In 1912 Mr. George Crocker left Columbia University two and one-half million dollars for cancer research, creating the Crocker Institute for Cancer Research, of which Dr. Wood became the Director, a capacity in which he remained until 1940, when he reached the compulsory retirement age of seventy. He was Professor Emeritus from 1940 until his death.

July 1, 1944, marked the 50th Anniversary of Dr. Wood's association with St. Luke's Hospital. As a fitting memorial, to honor him for his many years of service, his portrait was placed in the Medical Library of the hospital. He expressed his satisfaction at this honor by the typically cryptic comment that "Nobody goes there except for a sensible purpose—to read a book," and, again, that what he was "most proud of is that the hospital has pictures of angels, managers, and donors, but until this picture was hung never before has there been placed on its walls the most important part of a hospital—the doctor."

Dr. Wood's wide and varied interests brought him international recognition. He was a member of the Legion of Honor of France and the Belgian Order of the Crown. He was an Honorary Member of the Radiological Society of the Scandinavian Countries, Vice-President of the International Union Against Cancer, and in 1939 President of the Third International Cancer Congress held in Atlantic City. He was a member of the American Association of Pathologists and Bacteriologists, the Society of Experimental Biology and Medicine, the New York Pathological Society, the American Medical Association, the American Cancer Society, the American Association for Cancer Research, and the Association of American Physicians, and Emeritus Fellow of the College of American Pathology. He was a member, also, of Beta Theta Pi, Sigma Xi, and Phi Beta Kappa, and of the Century Association in New York City.

Dr. Wood became a member of the Radiological Society of North America in 1928. He was chosen as President-Elect of the organization in 1930 and assumed the Presidency in December 1931. His wise guidance and sincere deuotion carried the Society through one of its most turbulent and difficult periods. His ability as an editor and publisher was freely given to the journal of the society, a singular contribution that has been instrumental in placing RADIOLOGY on its present high plane. In 1939, at the Twenty-fifth Annual Meeting of the Society, in Atlanta, Dr. Wood delivered the Carman Lecture and was awarded the Gold Medal of the Radiological Society of North America.

From 1930 to 1941, Dr. Wood was editor of the *American Journal of Cancer*. He was the author of *Clinical Diagnosis* and *Chemical and Microscopical Diagnosis* and edited successive editions of Delafield and Prudden's *Text Book of Pathology*. After his retirement, he devoted his entire energy to compiling an *Atlas on Tumor Pathology*, including some fifteen hundred photomicrographic plates which he had prepared throughout his career and which are recognized as the most extensive collection in the field. This work will shortly be ready for publication.

Despite his many interests and the enormous demands on his time, Dr. Wood was never too busy to talk with and advise the young physician. His interest in research and investigative work made him one of the world's foremost authorities in the cancer field. His greatest contributions were educating the public to a proper attitude toward cancer, disproving sensational but false "cures" for the disease, and developing the three most effective methods of treating cancer—surgery, x-rays, and radium. He believed the cure of cancer could be effected only through a new understanding of the fundamental principles of cellular life, an explanation of the mystery of malignant cancer cells suddenly appearing, growing, and multiplying in a healthy human body, "We shall know the cause of cancer when we know the cause of life itself," he once said. "It is an independent life inside another life." Few people know or realize that Dr. Wood provided some of the early funds for the development of the cyclotron.

Surviving are a son, Francis Carter Wood, Jr., four daughters, Mrs. Mark H. Wiseman, Mrs. Aubrey Pershouse, Mrs. Dexter B. Peck, and Mrs. Edward C. Riley; two sisters, Mrs. Robert Laidlaw and Miss Charlotte Wood, three grandsons, and five granddaughters.

For those who were closely associated with Dr. Wood it was a prideful experience. His care of the poor and needy patient is legion. He was never too great or too busy to give of his time and skills. The inheritance he has left to the men in the field of cancer research and treatment will continue to be a demanding stimulus. DONALD S. CHILDS, M.D.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., U. S. Marine Hospital, Baltimore, Md.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arizona

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS. *Secretary*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Harold P. Tompkins, M.D., 658 South Westlake Ave. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Clifford W. Wauters, 701 High St., Auburn. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Merrell A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Paul E. RePass, M.D., 306 Republic Bldg., Denver 2. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Karl C. Corley, M.D., 1835 Eye St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Thos. H. Lipscomb, M.D., 30 West Beaver St., Jacksonville, 2. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, Theodore M. Berman, M.D., 350 Lincoln Road, Miami Beach. Meets monthly, last Wednesday, 8:00 P.M., in the Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ted F. Leigh, M.D., Emory University Hospital. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Americus. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Benjamin D. Braun, M.D., 6 N. Michigan Ave., Chicago 11. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Willard C. Smullen, M.D., St. Mary's Hospital, Decatur.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY, *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB, *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, H. R. Senturia, M.D., Pasteur Medical Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, L. L. Robbins, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday at the Harvard Club.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Peter J. Gianquinto, M.D., 685 High St., Newark 2. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, John L. Olpp, M.D., 49 Ivy Lane, Tenafly, N. J.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88-29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, A. Vaughn Winchell, M.D., 40 Meigs St. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, P. H. Woutat, M.D., 322 Demers Ave., Grand Forks.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Edward C. Elsey, M.D., 927 Carew Tower, Cincinnati 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Lawrence Gibboney, M.D., Carew Tower Bldg. Meets first Monday, September to May.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, C. Todd Jessell, M.D., 224 Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, at 8:00 P.M., University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr. Next annual meeting, Aug. 9–11, 1951, Denver.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, S. H. Fisher, M.D., 107 E. North St., Greenville. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets with State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, John E. Whiteleather, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

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TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting, Jan. 18–19, 1952, Houston.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. C. Kiltz, M.D., 705 Medical-Dental Bldg., Everett. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee. Meets in May and with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Jean Bouchard, M.D. Assoc. Hon. Secretary-Treasurer, D. L. McRae, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 26, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor* Luis Arrieta Sánchez, M.D., Apartado No. 86. Panama, R. de P.

ABSTRACTS OF CURRENT LITERATURE

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Osteoblastic Meningioma in a Child. Leo Madow and R. A. Farmer. Arch. Neurol. & Psychiat. **63:** 596–605, April 1950.

Meningiomas are rare in children and the osteoblastic variant is particularly infrequent. Less than 25 cases are believed to have been recorded in the literature. The authors report an additional example.

A 12-year-old girl with a history of jacksonian convulsions of eight years duration was hospitalized. Roentgenograms of the skull showed a huge calcified mass to the left of the vertex. On its superior side it appeared to invade the calvaria; its other surfaces were clearly demarcated, rounded and scalloped. The left anterior clinoid process was eroded. A large meningioma containing bone fragments and calcium deposits was removed at operation.

Three possibilities concerning the origin of the bone within the tumor are discussed: (1) The bone is formed by multipotential cells which make up the tumor itself. This is the most likely theory. (2) The bone comes from the overlying skull. This possibility was ruled out by the location of the bone within the tumor and the absence of endosteal projections from the surface. (3) The formation of bone is secondary to degeneration of tumor cells. This does not explain the source of the fibroblasts which cause ossification.

[The large size of the calcified tumor (273 gm.) would make one believe that it might have been found earlier if roentgenography had been done. The eight-year history of convulsions is impressive. Patients with undiagnosed cranial symptoms should have periodic roentgen studies of the skull.—M. R. C.]

Two roentgenograms; 5 photomicrographs; 1 photograph.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Surgical Treatment of Arnold-Chiari Malformation in Adults. An Explanation of Its Mechanism and Importance of Encephalography in Diagnosis. W. James Gardner and Robert J. Goodall. J. Neurosurg. **7:** 199–206, May 1950.

The authors have operated on 17 adults and adolescents with Arnold-Chiari malformation, and their experience suggests that the fundamental mechanism of this disorder is obstructive hydrocephalus with resulting foraminal herniation of the hindbrain.

The diagnosis may be confirmed by encephalography. The films will disclose evidence of obstructive hydrocephalus with absence of air in the cisterna magna. Since the intraventricular pressure is usually only slightly increased, this procedure is safe provided the surgeon is prepared to operate at once if the films confirm the diagnosis.

Roentgenograms of the 17 cases revealed definite evidence of platybasia in 8, suggested a mild degree of platybasia in 3, and were entirely negative in 4. Pneumoencephalography was performed in 11 cases, and little or no air entered the ventricles. The shape of the corpus callosum and lateral ventricles, when outlined, indicated the presence of hydrocephalus. The pontine cisterns were flattened, and air could not be demonstrated in the cisterna magna.

The surgical findings and treatment are discussed, and a case of acquired Arnold-Chiari malformation due to an acoustic tumor is reported. The author suggests that the associated hydromyelia in this case was due to the extrusion of fluid from the obstructed 4th ventricle downward into the central canal of the cord.

Arnold-Chiari malformation has been found in association with, and should be suspected in cases of, syringomyelia, syringobulbia, platybasia, Klippel-Feil syndrome and unexplained scoliosis, especially if cerebellar signs are present or if there is impairment of pain perception in the distribution of the 2nd cervical nerve.

Two roentgenograms; 3 photographs.

HARRY J. PERLBERG, JR., M.D.
New York, N. Y.

Arnold-Chiari Malformation. Everett F. Hurteau. J. Neurosurg. **7:** 282–284, May 1950.

A case of Arnold-Chiari malformation without malformation of the cervical spine is presented. An unusual finding was a flattening of the squama of the occipital bone. Ventriculography was essentially normal and failed to reveal the hydrocelphalus anticipated on the basis of the marked papilledema and suspected posterior fossa block.

The operative difficulties in this case are discussed. Relief was eventually obtained by a second and more complete cervical laminectomy.

Two roentgenograms.

HARRY J. PERLBERG, JR., M.D.
New York, N. Y.

Congenital Diverticulum of the Posterior Hypopharynx Simulating Atresia of the Esophagus. E. S. Brintnall and W. W. Kridelbaugh. Ann. Surg. **131:** 564–574, April 1950.

Two cases of congenital anomalies in the newborn, which gave identical symptoms and similar roentgenographic findings with swallowed lipiodol, are reported. In each instance a preoperative diagnosis of esophageal atresia with tracheo-esophageal fistula was made after a "blind upper segment" had been demonstrated both fluoroscopically and in the roentgenogram. At operation the obstructive symptoms were found to be due to a relatively large posterior midline hypopharyngeal diverticulum with its mouth located above the cricopharyngeus fibers. No similar cases were found in the literature.

Commenting on their cases, the authors state that, although fluoroscopic examinations and roentgenograms failed to demonstrate any swallowed opaque material passing down the normal esophagus, the presence of air in the stomach in the absence of tracheo-esophageal fistula indicated that the esophagus was, physiologically at least, partially patent. In the first case the lipiodol-filled sac was dilated and did not differ in contour roentgenographically from a lipiodol-filled upper esophageal segment in esophageal atresia. Pharyngoscopy in this case was inconclusive; the esophagoscope passed into the diverticulum and the silt-like esophageal aperture, which was located anterior to the diverticulum, was thought to represent a cleft in an esophageal membrane. In the second case, pharyngoscopy performed at operation after a normal esophagus was found, revealed clearly the apertures of esophagus and diver-

ticulum; the relationship of diverticulum to esophagus was then demonstrated by passing catheters into each of these openings.

Eight illustrations, including 2 roentgenograms.

GLENN F. MILLER, M.D.
The Henry Ford Hospital

Origin and Treatment of Osteomas of the Paranasal Sinuses. Olav Erik Hallberg and Joseph W. Begley, Jr. Arch. Otolaryng. **51:** 750–760, May 1950.

Fifty-one cases of osteoma of the paranasal sinuses have been encountered at the Mayo Clinic since 1930. Thirty-six of the patients were male and 15 female. In 40 cases the osteoma arose in the frontal sinuses, in 9 cases in the ethmoid sinuses, and in 2 cases in the maxillary sinus.

Osteomas are said to be the most frequently encountered neoplasms of the frontal sinuses. The most common symptom of osteoma in this location is frontal pain. Other symptoms are profuse nasal discharge and periorbital swelling, which may cause displacement of the eyeball and diplopia. Those patients with purulent nasal discharge had an associated infection of the frontal sinuses which was demonstrated roentgenologically on the basis of evidence of retained secretion and thickened mucous membrane.

Osteomas of the ethmoid sinuses involve neighboring structures early. Frontal or maxillary pain was the commonest symptom. Other symptoms and signs were nasal obstruction, a palpable mass in the orbit, nasal discharge, displacement of the eyeball, and diplopia.

True osteomas of the maxillary sinus are rare. Symptoms were indefinite pain for a year or two. Roentgenograms showed, in addition to the tumor, thickening of the mucous membrane.

No cases of osteoma originating in the sphenoid sinus have been reported in the literature.

Four roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

THE CHEST

X-Ray Appearances of Acquired Atelectasis of the Upper Lobes. G. Simon. J. Faculty Radiologists **1:** 223–230, April 1950.

Collapse of the upper lobes of the lung is less well known and less common than collapse of the lower or right middle lobes. Since this condition may be confused with apical thickening or mediastinal tumor, the author has felt it important enough to make a study of this subject and review the literature. A clear, concise description of the various appearances is presented, along with reproductions of roentgenograms and tomograms of many cases. The author has failed, however, to give credit to the excellent description of this condition by Robbins and Hale (Radiology **45:** 347, 1945).

Atelectasis of the right upper lobe produces a homogeneous shadow in the right upper zone, reaching to the apex, with a characteristic concave inferior margin. Elevation of the diaphragm or compensatory emphysema is rarely seen. Associated abnormality of the vascular markings is an important feature; the upper lobe vessels are swung upward and become invisible in the dense shadow of the collapsed lobe, while lower lobe vessels are abnormally spread out. Tomograms taken to show the main vessels bring out this abnormality very clearly.

Atelectasis of the left upper lobe is very similar in appearance, but because of the addition of the lingula produces a larger shadow which tends to lie in the medial half of the left lung field, barely reaching to the apex and having poorly defined lateral and inferior margins.

Lateral views are extremely important in visualizing collapse of either upper lobe.

Twenty-four roentgenograms.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Suppurative Complications of Thoracicoabdominal Wounds. Joseph P. Lynch. Am. J. Surg. **79:** 621–634, May 1950.

This article is a review of the late complications of thoraco-abdominal wounds seen at a thoracic surgery center in England during the Second World War. The cases are selected to include only those with combined lesions in the thoracic and subphrenic areas.

Any patient with persistent fever, or a persistent draining sinus, whose original wound was thoracoabdominal was suspected of a subphrenic complication. A careful search was made for its presence even though an adequate cause for the fever was evident elsewhere. Thoracenteses were performed for all pleural effusions. Abscess formation was searched for radiographically by means of sinus tract injection with opaque media. Possible transdiaphragmatic extensions were studied by lipiodol injection into the thoracic cavity following thoracentesis.

The basic therapeutic measure was wide surgical drainage with modifications according to the existing conditions. Empyema and subphrenic abscesses were treated independently with wide drainage, each as if the other did not exist, if no communication could be demonstrated. If a communication existed, open drainage of the empyema with drainage of the subphrenic abscess through the chest was instituted, provided the empyema cavity was less than 500 c.c. in volume. Because recovery was slow with the above method if the empyema cavity was large, such cases were treated by decortication, enlarging the communication, and evacuation of the abscess followed by repair of the diaphragm and subphrenic drainage. Left-sided lesions with herniation of the stomach into an infected thoracic cavity were treated by repair of the gastric herniation, with replacement of the stomach in the abdomen and repair of the diaphragm.

Twenty-nine roentgenograms; 2 drawings.

JOHN WEIGEN, M.D.
University of Pennsylvania

A Consideration of the Roentgen Diagnosis of Chronic Pulmonary Granulomatosis of Beryllium Workers. Agrippa G. Robert. Am. J. Roentgenol. **63:** 467–487, April 1950.

The author introduces his paper with a brief summary of the history of the development of beryllium as well as its physical and chemical characteristics and present industrial applications. In workers engaged in certain of these industrial processes, a new disease has appeared. This may take the form of an acute or chronic illness. In the acute form the skin, mucous membranes of the upper respiratory passages, and the lungs are involved. The chronic form, with which the author is concerned here, leads to severe disability and is akin to the specific pneumoconioses in that it may be productive of varying degrees of pulmonary fibrosis.

The incidence of chronic pulmonary granulomatosis is low even in environments thought to have been productive of other cases. Clinically, the latent period between the time of exposure and the onset of illness is extraordinarily inconstant, varying from a few months to more than five years. In all except the occasional mild and asymptomatic cases dyspnea is a constant complaint. It is usually accompanied by cough, anorexia, weight loss, and easy fatigability, and occasionally by temperatures of 103 or 104° F. Except for cyanosis and scattered râles these physical findings are not striking. A polycythemia is usually present in all except the mildest cases, and a moderate eosinophilia without an accompanying leukocytosis is common.

The ultimate prognosis in any given case is indeterminate. The course of the disease is progressive over a period of months to years, with a final termination either in death from respiratory or cardiac failure, or in improvement through a slow regression.

Pathologically the lesions consist of a diffuse chronic inflammatory or granulomatous type of reaction, with scattered nodular lesions localized primarily within the walls of the alveoli, but occurring also within the septa and adventitial tissues of the blood vessels and bronchi. The alveolar walls are thickened by the presence of macrophages, lymphocytes, plasma cells, and at times by an overgrowth of connective tissue which may subsequently undergo an advanced degree of hyalinization. Multinucleated giant cells are also a common component of the lesions. As a result either of the continued cellular or fibrotic reaction, or both, the normal architecture of the lungs becomes obliterated in cases showing extensive involvement. Some of the alveoli are small, in areas of relative consolidation, while others are dilated and emphysematous. The "unit lesion" of the process may be described as a nodular granuloma. Grossly, these granulomas are rarely more than 1 mm. in diameter, and nodules are distributed with considerable regularity throughout both lungs. Different cases and different areas in the same case may respond quite differently histopathologically. In most cases the response is primarily cellular, whereas in other situations the presence of connective-tissue proliferation and hyaline fibrosis predominates. In any given case all of the variations in structure of the unit lesion are likely to be encountered, and there is no good correlation between the age of the process and the prominence of its contained fibrosis. Pathologically, therefore, the justification is meager for attempting to identify in roentgenograms stages in the evolution of the morbid process as a whole. By the same token one can expect little information from the roentgenogram regarding prognosis, except that the outlook may be affected through an estimation of the extensiveness of involvement.

The tracheobronchial lymph nodes are usually enlarged and soft, and on microscopic examination reveal the presence of occasional tiny granulomas identical with those in the lungs. Occasionally similar lesions are sparsely distributed through the systemic lymph nodes, spleen, liver, and bone marrow.

Due to the protean manifestations and for convenience of description, two or three roentgenologic types are generally recognized. These are (1) granular, (2) reticular, and (3) nodular. In all three the involvement is diffuse, although not necessarily uniform throughout both lungs. The granular form presents on the roentgenogram a general stippled or fine sandpaper appearance which at first may be suggestive of pulmonary edema but on close inspection is found to be distinctly particulate in nature. The changes are generalized usually, although they may be more apparent in the middle thirds of the lung fields, at which locations a progressive tendency to coalescence, with the formation of densely confluent areas of infiltration, may be a late phenomenon. In the granular form there is no apparent enlargement of the hilar lymph nodes and no exaggeration of linear markings.

In the reticular type there may be, as in the former group, a bilateral diffuse granularity, but there is additional generalized reticulation, as well as indistinct hilar shadows, which are somewhat enlarged as the result of a slight but definite lymphadenopathy.

In the nodular type of chronic pulmonary granulomatosis the roentgenogram demonstrates a diffuse nodulation distributed more or less evenly throughout both lungs. The nodules may vary in size from 1 to 5 mm. in diameter in different individuals, but in a given case they are generally quite uniform in size. The hili are frequently ill defined and present a hazy appearance; they are usually the site of a decided lymphadenopathy, although this is not an invariable corollary finding. There is little tendency to actual coalescence of the nodular shadows, although in the upper lung fields a quite definite concentration of the nodules may appear. When present, this latter phenomenon may be associated with either an elevation of the interlobar fissures or with an upward displacement of the hilar shadows or both.

The author stresses the fact that, despite the occurrence in most cases of chronic pulmonary granulomatosis of a granular pattern, the roentgenogram alone does not present a picture sufficiently characteristic to warrant a definite diagnosis. In the differential diagnosis one must consider Boeck's sarcoid, silicosis, the mycoses, some aspects of cardiovascular diseases, etc. Critical correlation of the roentgen findings with all other available data is essential.

Thirty-one roentgenograms; 2 photomicrographs. Excellent bibliography.

E. S. KEREKES, M.D.
University of Arkansas

A Type of Pneumoconiosis. Arthur A. Hobbs, Jr. Am. J. Roentgenol. **63:** 488–497, April 1950.

Hazardous silicates are discussed with the reminder that coarse particles are managed by ciliary action while those not more than one micron in size are, to some extent, disposed of by the lymphatics. A pneumoconiosis occurring in talc miners, similar to asbestosis, is described.

In pneumoconiosis due either to talc or asbestos there is early lung field haziness with reticulate or soft nodulations which are fine and delicate as distinguished from the coarser nodulations of ordinary silicosis. As the condition progresses, the lesions tend to become confluent and more dense, with a predilection for pleural involvement. Development may be asymmetrical. In this type the symptoms are more marked than the roentgenologic appearance would suggest.

The author's clinical material covers 13 cases, including 7 from an earlier series (Am. J. Roentgenol. **47:** 507, 1942. Abst. in Radiology **40:** 618, 1943) and 6 new cases, in none of which was pneumoconiosis the cause of admission, though all had clinical manifestations of the condition. Four representative cases are presented in detail. Complaints of dyspnea, anorexia, and weight loss were prominent. Vital capacity and chest expan-

sion were consistently below normal. Roentgen studies showed haziness about lower lobe trunks and soft nodulations in the peripheral zones. Fluoroscopically diaphragmatic excursion was reduced to a greater extent than would be expected from film studies. Infectious pneumonitis is a serious complication and need not be tuberculous. One case complicating bronchogenic carcinoma is included, and it is suggested that there may be more than a casual relationship between the two conditions.

Seven roentgenograms; 2 photomicrographs.

HOWARD B. BURNSIDE, M.D.
University of Arkansas

Kerosene Intoxication. Edsel S. Reed, Sanford Leikin, and Herbert D. Kerman. Am. J. Dis. Child. **79:** 623–632, April 1950.

The literature relative to the pathogenesis of pulmonary changes secondary to kerosene intoxication is reviewed. The majority of the authors quoted believe that the involvement is the result of aspiration into the respiratory tract. Absorption from the gastro-intestinal tract with excretion into the lungs is suggested as the mechanism by others.

Twenty-five unselected cases of kerosene ingestion were studied clinically and roentgenographically during a four-year period, with follow-up studies from six months to four years after the ingestion of fluid.

Pertinent clinical findings were as follows: (1) Eight patients had clinical evidence of pneumonia. (2) Coughing, gasping, choking, and strangulation were the common respiratory findings. (3) Lethargy was observed in 8 patients. (4) Vomiting was a prominent early symptom, occurring in 12 patients. (5) White blood cell counts ranged from 6,450 to 35,200 per cubic millimeter. (6) Temperature was elevated in 80 per cent of the patients. Treatment consisted of antibiotics and gastric lavage. Oxygen was administered to the patients who were cyanotic.

The criterion for diagnosis of pulmonary abnormalities roentgenographically consisted in the finding of definite areas of increased density in the pulmonary fields. Prominence of the bronchovascular markings alone was not considered as evidence of involvement. Definite pulmonary changes were observed in 86 per cent of the series. These varied from a small patchy density to large mottled confluent shadows. The lung changes were most often bilateral. They developed rapidly after the ingestion of kerosene and usually resolved in two weeks.

The abrupt onset of symptoms plus the rapid development of roentgenographic changes suggest that the primary acute pulmonary change is one of pulmonary hyperemia and edema. Follow-up studies failed to reveal any evidence of pulmonary fibrosis or other residual abnormalities.

Eight roentgenograms; 1 table.

NORMAN GLAZER, M.D.
Cleveland City Hospital

Emphysematous Bulla Complicated by Hemorrhage and Infection Treated with Surgical Drainage. Wilson Weisel and Irvin Slotnik. Am. Rev. Tuberc. **61:** 742–746, May 1950.

The authors' patient evidently had had an emphysematous bulla in the left lower lung field for several years before admission to the Veterans Administration Hospital, Wood, Wis. Shortly before admission he experienced a sudden onset of dyspnea followed by cough productive of brown fluid. When roentgenograms showed homogeneous density in the left lower hemithorax, aspiration was done and bloody fluid was obtained. The illness was further complicated by development of infection in the bulla. This led to surgical drainage, which produced dramatic relief of symptoms and subsequent disappearance of the bulla upon postoperative roentgen examination of the chest.

Four roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

Pulmonary Tuberculosis in University of Buffalo Medical Students. M. H. Schuck and A. H. Aaron. Dis. of Chest **17:** 442–449, April 1950.

Because some consider pulmonary tuberculosis an occupational hazard for medical students, and because there was an unduly high incidence of significant pulmonary tuberculosis in the University of Buffalo Medical School, a survey was begun in 1942 in order to (1) discover new cases early, (2) check tuberculin conversion rate, and (3) indoctrinate the students with regard to early diagnosis and treatment of the disease.

The authors report their findings on 679 students, examined from July 1942 to June 1946. Each student had an x-ray examination of the chest three times a year, and a tuberculin test once each year.

Twelve cases of tuberculosis were discovered (1.8 per cent), 11 of significant disease, and 1 of tuberculous pleural effusion. Five cases were discovered during the first year, 4 minimal and 1 moderately advanced; 3 during the second year, 2 minimal and 1 with a pleural effusion; none during the third year; 4 during the fourth year, 3 minimal and 1 moderately advanced.

The average age for the freshman classes was 22.6 years. The average number of tuberculin positive reactors for the first year was 23.4, for the second year 28.6, for the third year 37, and for the fourth year 46.2. The percentage of freshmen who entered with positive tuberculin reactions varied from 15 to 37 per cent. Of the tuberculin negative reactors, 27 per cent became positive reactors during their school years. Significant tuberculous disease developed in 7 of the 12 cases one year or less after discovery of tuberculin conversion.

Three tables.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Surgical Treatment of Round Tuberculous Pulmonary Lesions (Tuberculomas). Hugh W. Mahon and James H. Forsee. J. Thoracic Surg. **19:** 724–739, May 1950.

After a critical discussion of the term "tuberculoma" and a description of the pathogenesis of the lesion, the authors cite their experience in the removal of 48 tuberculomas. In three-fourths of these cases the lesion was discovered by chance on a routine chest roentgenogram. In known cases of tuberculosis their development was followed by repeated x-ray examinations, showing them to be the end-result of a tuberculous pneumonia or of the solidification of a tuberculous cavity, usually as the result of compression therapy. Pathologic study of the specimens showed various phases of development from immaturity to "ripeness." Many of the former were loaded with tubercle bacilli.

Unfortunately, the large majority of the solid nodules are slow to calcify and mature; one in this series was observed for eight years, when it began to soften and the sputum became positive. They often show small areas of softening and liquefaction, evidenced in the

roentgenograms by small eccentric lucencies which may shift within the nodule when followed by serial films. It is rather characteristic that these lucencies are located at the junction of the caseous and fibrous zones and often appear in the x-ray shadows as peripheral "slits" following the curve of the wall of the nodule.

It is pointed out that these lesions are potentially dangerous and proof is provided that some break down to produce acute tuberculous pneumonic flare-ups. Also, there is no medical treatment that will clear up these nodules. Streptomycin has no effect on them. In addition, a small percentage of parenchymal round lesions turn out to be malignant tumors on histologic examination.

The authors favor wedge resection as the method of removal, although segmental or even total lobectomy was necessary in one-third of their cases. The operative risk was low. There were no operative deaths in this series and no instances of postoperative tuberculous pleurisy.

Ten illustrations, including 6 roentgenograms.

HAROLD O. PETERSON, M.D.
University of Minnesota

Sarcoidosis, with Special Reference to Lung Changes. J. G. Scadding. Brit. M. J. **1:** 745–753, April 1, 1950.

The author, whose experience covers 16 cases of sarcoidosis, classifies the radiological aspects under five headings, and presents illustrative cases under each: (1) enlargement, either unilateral or bilateral, of the hilar lymph nodes with no demonstrable lung involvement; (2) bilateral hilar node enlargement with a fine diffuse mottling in the lungs; (3) diffuse pulmonary infiltration varying from a miliary appearance to irregular coarse nodules; (4) fine reticulation throughout, with normal hilar shadows; (5) fibrosis, emphysema, and bulla formation.

Forms 1, 2, and 3 may clear spontaneously, persist unchanged for years, or progress to fibrosis. Cavities are seen at times, but it is difficult to determine if they are the result of tissue necrosis or bulla formation.

In 10 to 20 per cent of cases, clinical tuberculosis develops, with postive sputum, allowing no sharp line of differentiation to be drawn between the two conditions. Erythema nodosum with hilar node enlargement and negative Mantoux reaction may well be related to sarcoidosis.

Calciferol seems to the author to give good results in lung involvement, although some patients are not able to tolerate it.

This article is recommended in the original to those especially interested in the subject.

Thirteen illustrations, including 9 roentgenograms; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Study on the Problem of Incomplete Pneumothorax. Kaolin Dusting of the Pleural Space (with a Technical Supplement). E. R. Mordasini and H. Sighart. Schweiz. med. Wchnschr. **80:** 386–392, April 15, 1950. (In German)

Incomplete pneumothorax with unsatisfactory stabilization of the tuberculous process often leads to bad results, and not infrequently, following heavy pleural thickening, to damage of an otherwise healthy lower lobe, while caustic applications to the pleura, with or without extrapleural lysis, lead to severe pleurisy, empyema, or perforation of cavities. The authors have found that an incomplete pneumothorax can be caused to expand with minimal delay, not infrequently with marked improvement of the tuberculous process and closing of cavities, both clinically and roentgenologically. To permit other collapse therapy, they tried to destroy the pleural space by dusting with kaolin, strictly avoiding heavy pleural thickening. This resulted in a surprising improvement, a third of the patients being slightly improved and another third practically cured, with closure of cavities up to the size of an orange.

Forty-nine roentgenograms.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Primary Lymphosarcoma of the Lung: Report of a Case. A. John Anlyan, C. G. Lovingood, and Karl P. Klassen. Surgery **27:** 559–563, April 1950.

A case of primary lymphosarcoma of the lung is presented, which was dignosed following exploratory thoracotomy and treated by lobectomy. There was no evidence of extension of the malignant process to any other part of the body.

This is the fifth primary lymphosarcoma of the lung described in the available literature. All 5 have been of the lymphocytic type. In 2 of the cases previously reported the lymphosarcoma was apparently limited to one lung, in 1 it had involved the opposite lung, and in 1 it had metastasized to the sternum, ribs, and liver.

The authors' patient was a 63-year-old white man who was essentially well and was prevailed upon to enter the hospital because of an abnormal "shadow" found on a routine chest film. X-ray studies of the chest showed an area of increased density at the base of the right lung posteriorly near the spine. The lesion was sharp in outline, homogeneous, and measured 4 × 4 cm. There was no increase of hilar shadows. Comparison with chest films taken nine and seven months previously showed no apparent change in the size or extent of the shadow. Bronchograms revealed partial narrowing of the bronchus supplying the involved part; however, there was no distal dilatation.

Three roentgenograms; 1 photograph; 2 photomicrographs.

JAMES T. BOGGS, M.D.
Emory University School of Medicine

Roentgen Diagnosis of Pleural Mesothelioma (Endothelioma). Case Report. Harold Schwartz. Am. J. Roentgenol. **63:** 530–535, April 1950.

The author presents a case of pleural mesothelioma or endothelioma in a white male aged 62, who was first seen after an intermittent "sticking" pain in the left chest of ten weeks duration. The initial roentgen examination showed pleural thickening localized to the upper half of the pleural space. Several weeks later osteolytic lesions were demonstrated in the left upper ribs. It was believed that a malignant chest tumor was present, and palliative roentgen therapy was administered, without effect.

Subsequently a left Horner's syndrome developed, with excessive perspiration over the entire right side of the body, a progressive anemia, and roentgen evidence of a phrenic paralysis on the left. The patient died approximately eight and a half months following his admission.

Autopsy revealed a dense, rubbery tumor involving the entire left pleura, including the diaphragmatic surface. It also infiltrated and involved practically the entire sympathetic nerve chain on the left side and the

posterior nerve roots on that side. The neoplasm was very tightly adherent to the posterior and lateral walls of the chest cavity, invading many of the contiguous ribs. There were a few metastatic nodules in the right pleura, and the second, fourth, and seventh ribs on this side showed metastatic deposits. There were metastases also in the epicardium, throughout the lung, throughout the liver, in both adrenals, in both kidneys, and in the omentum and retroperitoneal fat. The microscopic picture is described in detail.

This case differs from the usual case of pleural endothelioma in that roentgenograms showed only pleural thickening without evidence of effusion or parenchymal or pleural nodules.

Six roentgenograms; 1 photomicrograph; 1 photograph.

I. MESCHAN, M.D.
University of Arkansas

Iodized Poppyseed Oil Granuloma. Report of a Case. H. C. Fortner and J. S. Miles. Arch. Path. **49:** 447–452, April 1950.

The occurrence of pulmonary granulomatous lesions presumably due to the previous instillation of lipiodol is reported. The patient was a 43-year-old male with a diagnosis of pulmonary tuberculosis and bronchiectasis, who had repeated pulmonary hemorrhages. Iodized oil was introduced into the tracheobronchial tree on four occasions over a two-year period. Seven months after the last instillation, roentgenograms of the chest revealed no trace of the oil. Six years after the last instillation, a pneumonectomy was performed. A microscopic examination revealed foci of granulomatous tissue with occasional foreign-body giant cells surrounding circular spaces. Sudan stain and osmic acid stain revealed oil droplets which were presumed to represent lipiodol.

Two illustrations.

HOWARD L. STEINBACH, M.D.
University of California

Kahler's Disease Localized in the Thorax with Bilateral Pleural Involvement Demonstrated by Systematic Fluoroscopy. H. Boucher, Darbon, Steiger, and Prat. J. franç. de méd. et chir. thorac. **4:** 396–398, 1950. (In French)

A case is reported to illustrate the value of systematic or routine fluoroscopy. A large and vigorous 20-year-old soldier was referred with the notation: "Bilateral pleural sequelae revealed by systematic radioscopy." The patient had no pain, fever, or functional respiratory symptoms. He exhibited surprise at the discovery of pleurisy, as he had never been ill and had participated in strenuous athletic activities. A chest roentgenogram revealed bilateral pleural effusion, elevation of diaphragmatic cupolas, and a "multiareolar" appearance of some of the ribs. The right sixth and seventh ribs were also fractured and a loss of substance was noted in the latter. Blood studies, sternal puncture, and urine studies, including Bence-Jones' test were normal. Rib biopsy revealed myeloma. Other bones being normal, it is concluded that the myelomatous process was localized to the thorax.

Three roentgenograms.

CHARLES NICE, M.D.
University of Minnesota

Mesothelial Mediastinal Cysts. Pericardial Celomic Cysts of Lambert. E. C. Drash and Harry J. Hyer. J. Thoracic Surg. **19:** 755–767, May 1950.

The cysts which form the subject of this paper have been variously designated as "pericardial celomic cysts," "pleura-diaphragmatic cysts," "simple cysts of the mediastinum," "springwater cysts," "serosal cysts." They usually occur in the cardiophrenic angle adjacent to the pericardium, diaphragm, and anterior chest wall. They are thin-walled, unilocular, and contain clear fluid. Microscopically the wall consists of fibrous tissue lined by endothelial or mesothelial cells. If small, these cysts cause no symptoms and are found incidentally on chest roentgenograms. If large, they may compress the mediastinum and cause cough, dyspnea, and chest pain. In the differential diagnosis, parasitic cysts, teratoma, dermoid, lymphangioma, and lipoma must be considered. The exact diagnosis depends upon surgical exploration. Two theories of pathogenesis have been advanced, the more plausible of which suggests an origin by aberrant growth from the mesothelium of the pleural cavity as it invades the mesenchyme of the body wall. Treatment by surgical excision is successful and safe.

The authors describe 5 cases of their own and summarize 16 from the literature.

Twelve illustrations, including 9 roentgenograms; 1 table.

HAROLD O. PETERSON, M.D.
University of Minnesota

Supradiaphragmatic Thoracic-Duct Cyst. An Unusual Mediastinal Tumor. George L. Emerson. New England J. Med. **242:** 575–578, April 13, 1950.

A review of the literature on cysts of the thoracic duct is presented. Only 7 cases have been previously reported, of which 4 were supradiaphragmatic. The etiology of the condition is unknown, and it is usually discovered only at autopsy.

The author's patient was a 20-year-old single female, in whom a mediastinal mass had been discovered two and one-half years previously. This mass had definitely increased in size during the interval. A complicating factor was a long-standing anxiety-neurosis. The temperature was 100.4° F. and the pulse 110. The white cell count was 11,000. The corrected sedimentation rate was 23 mm. in one hour. Roentgen examination of the chest, including laminagraphy, showed a soft-tissue mass in the right of the mid-mediastinum, somewhat posteriorly, measuring about 4 × 7 cm. but without calcification or a fluid level. A definite atelectasis of the right lower lobe was noted. Bronchoscopy demonstrated compression of the lower right bronchus by the mass. At operation a thoracic duct cyst was found. The patient continued to run a low-grade fever following discharge, but the sedimentation rate was normal.

Four roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Syndrome of Cardiopulmonary Schistosomiasis (Cor Pulmonale). M. Radwan Kenawy. Am. Heart J. **39:** 678–696, May 1950.

Seven cases of bilharzial cor pulmonale, with necropsy findings in 1 case, are presented. Cardiopulmonary bilharziasis was associated with 7.5 per cent of 682 cases of Egyptian splenomegaly seen in the Fouad I Hospital, Cairo, Egypt, during the two years prior to the time of this report. Symptoms are usually cardiac or pulmonary; most of the patients show evidence of congestive heart failure, with precordial pain or syncope. Two of the patients in the author's series had hemoptysis. Neither clubbing of the fingers nor cyanosis is a constant feature.

X-ray examination reveals an enlarged right ventricle, forming the left border of the heart instead of the left ventricle, which moves, counterclockwise, out of view with the rotation of the heart as a whole; the aortic arch shares in this rotation, with the result that the aortic knob appears to be absent. The heart takes the form of the familiar "mitral configuration," but there is a characteristic bulging of the pulmonary conus upward, as a result of the gross dilatation of the pulmonary artery. The left auricle does not show any degree of enlargement. A triangular shadow due to the enlarged right branch of the pulmonary artery may be seen in the right hilus. In advanced cases this shadow is dense and takes the shape of the clot (in these cases there is postmortem evidence of an organized thrombus).

Radiologic evidence of bilharziasis is often visible in the lungs. Fine mottling of diffuse character, unlike that of tuberculous infiltrations, may be observed in the roentgenogram of any part of the lung field. In other patients, the x-ray appearance often suggests miliary tubercules which are of a bilharzial nature. If tartar emetic is administered in these cases, later films will show an accentuation of the shadows to the extent of a bronchopneumonic appearance. This is supposed to be an allergic phenomenon. The changes are reversible, for once tartar emetic is discontinued the shadows again regress and the field becomes clearer.

Diseases which may simulate bilharzial cor pulmonale include rheumatic mitral incompetence, patent interauricular septum, patent ductus arteriosus, and the cardiac type of beriberi. Differentiation is easy if the possibility of bilharziasis is kept in mind and associated visceral lesions are sought. Patent interauricular septum is the only condition which closely simulates the syndrome both clinically and radiologically. It can be differentiated by the typical machinery murmur and the absence of associated visceral disease.

The presence of heart failure is an absolute contraindication to the use of antimony; digitalis and mercurial diuretics are to be administered. In order to decrease the number of persons with cor pulmonale, patients with hepatosplenomegaly and urinary bilharziasis should receive a full course of antimony at an early stage.

Eleven figures, with 5 roentgenograms.

Arteriovenous Fistulas of the Lungs. Samuel Baer, Albert Behrend, and Harold L. Goldburgh. Circulation 1: 602–612, April 1950.

A rather unusual case of an important (because it is usually curable) and recently publicized disease, arteriovenous fistula of the lung, is presented in great detail. An interesting feature of this case was the response of the lesions to surgery. The patient was operated upon three times, the right lower lobe, left lower lobe, and lingular portion of the left upper lobe being removed. Each time operation was performed, one of the lesions left behind would enlarge and symptoms would return. A footnote added to the article states that a new fistula had developed in the right lung after the present report was written. The patient presented the classical signs and symptoms of the disease, *i.e.*, cyanosis, clubbing of the digits, polycythemia, bruits over the lung lesions, nodular densities demonstrable radiographically, and negative heart findings except for slight enlargement.

Many patients have associated telangiectasis of the skin. The father of the authors' patient had some telangiectases and nodular and cylindrical shadows in the lung fields suggestive of pulmonary hemangioma.

[Two things are not mentioned in regard to x-ray findings: (1) change in size of the lesions with the Valsalva and Mueller procedures; (2) demonstration of enlarged vessels between the lesions and the hilus.—Z. F. E.]

Six roentgenograms; 4 graphs; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Case of Marked Dilatation of the Pulmonary Arterial Tree Associated with Mitral Stenosis. S. Segall, I. I. Ritter, and W. Hwang. Circulation 1: 777–781, April 1950.

A woman of 42 had been under repeated observation in the Michael Reese Hospital (Chicago) since 1939. She gave a history of mitral stenosis first diagnosed at the age of fourteen. During the period of observation she had experienced repeated episodes of cardiac failure and exhibited typical findings of mitral stenosis. In 1940 she had acute rheumatic fever with pancarditis and congestive failure. At that time a right bundle branch block developed.

Fluoroscopy in 1943 and repeatedly thereafter revealed a markedly dilated pulmonary artery trunk and two left hilar masses and one in the right mid-lung field, all thought to be aneurysmal dilatations of the pulmonary artery main stem branches. Films obtained in 1933 and 1936 were available, showing similar masses. By 1940 there was incomplete calcification at the periphery which had increased by 1943 but showed no further change in 1948. The left ventricle was normal in size, the right ventricle and both auricles were markedly enlarged.

On the patient's last admission (1948) she was orthopneic, cyanosed, and edematous, with typical mitral murmur and markedly enlarged heart.

Catheterization studies led to the following conclusions: (1) Roentgenologic visualization of the catheter in the large masses established their identity as parts of a dilated pulmonary arterial tree. (2) Since the blood samples taken from the superior vena cava, the right auricle, and the pulmonary artery did not differ significantly in oxygen content, the possibility of a patent ductus arteriosus or of a septal defect was ruled out. (3) The marked unsaturation of the peripheral arterial blood strongly suggested pulmonary arteriolar disease with poor respiratory gas exchange. The relatively high cardiac output in all probability acted as a compensatory mechanism, similar to that in chronic cor pulmonale and in emphysema. (4) The high pressures in the pulmonary artery and right ventricle were probably due to a combination of (*a*) mechanical obstructions at the mitral valve and (*b*) increased peripheral pulmonary resistance by an altered pulmonary arteriolar bed. The equality of systolic pressure in the pulmonary artery and right ventricle eliminated the possibility of pulmonary stenosis.

Previously reported cases of idiopathic congenital dilatation of the pulmonary artery have shown low pulmonary artery pressure attributed to turbulence, to an increase in expansibility of the pulmonary arteries, or to relative pulmonary artery stenosis. The high pressure in this case points to associated lesions. The authors cite various cases from the literature with associated mitral stenosis and atheromatosis.

Whether the pulmonary arteriolar changes suggested in this study were secondary to mitral stenosis or due to a congenital inherent weakness remains unknown.

Four roentgenograms. R. JEAN ROMER, M.D.
Baton Rouge, La.

Radiological Features of Enlarged Bronchial Arteries. Maurice Campbell and Frances Gardner. Brit. Heart J. **12:** 183–200, April 1950.

In cases of pulmonary atresia and truncus arteriosus the blood supply to the lungs is maintained by enlarged bronchial arteries and anastomotic branches from the aorta if the ductus arteriosus closes (as it usually does, even though the blood it supplies is needed so badly).

From 5 proved and 2 unproved cases, a fairly characteristic picture has been evolved. On the posteroanterior film there is absence of the normal "comma" shadow representing the pulmonary arteries and in its place either many irregular vessels or rounded nodular shadows with rather straight branches attenuating more rapidly than normal. On the right side the vessels are prominent in the upper mediastinal area.

Angiocardiography in lateral or left anterior oblique positions shows filling of the enlarged bronchial arteries after the aorta and demonstrates their unusually straight branches spreading out fanwise in the lung fields, as seen on the plain films.

Seven case reports are given with good reproductions of both plain films and angiocardiograms. The article is recommended in the original for those interested in congenital heart disease.

Twenty-two roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Cardiac Aneurysm. Bernard Berman and Johnson McGuire. Am. J. Med. **8:** 480–489, April 1950.

The literature on cardiac aneurysm is reviewed, and 26 cases proved by postmortem examination are analyzed. Eighteen of the patients were males. The average age of the entire group was 65.8 years.

As in other series, in the majority of cases recognized before death, the diagnosis was first suggested by the roentgen findings. Both oblique and anteroposterior views should be utilized. Helpful diagnostic criteria are the presence of angulations, incisura, calcifications, increases in density, pericardial adhesions, and bulgings.

There was involvement of the apical portion of the left ventricle in the largest group of cases, with the aneurysm appearing on the anterior wall. This aneurysm commonly followed occlusion of the anterior descending branch of the left coronary artery.

Features helpful in making the diagnosis of cardiac aneurysm are: a history of coronary occlusion, normal or low blood pressure, cardiac enlargement, distant or weak heart sounds or a weak first sound, persistence of congestive failure after the onset of failure following a myocardial infarction, visible and palpable apex beat within the outer border of cardiac dullness, heaving precordial thrust, cardiac impulse separate from that of the apical impulse, and disproportion between the heart sounds and the precordial thrust. Pain over the apex, a to-and-fro murmur heard over the apex, and immobilization of the apex are also suggestive. A rough, loud systolic murmur occurring suddenly following myocardial infarction should arouse suspicion as to the possible presence of an aneurysm, in addition to the possibility of a perforated septum, rupture of valvular cusp or chorda tendinae. No pathognomonic electrocardiographic changes were found in the 26 cases studied.

The prognosis in this series was quite favorable. One patient survived seventeen years following the development of a ventricular aneurysm. Death was commonly due to congestive failure.

Four roentgenograms; 3 photographs.

Healed Dissecting Aneurysm of the Aorta Erroneously Diagnosed Paramediastinal Effusion; Death Following Attempted Aspiration. J. Chandler Smith and Salvatore M. Sancetta. Circulation **1:** 792–796, April 1950.

This is a case report of a 27-year-old white man, known to have tuberculosis, with a healed dissecting aneurysm of the aorta. The dissection was limited to the media, there being no intimal tear, no external rupture, and no area of re-entry. The roentgen shadow of the aneurysm was interpreted as representing a paramediastinal effusion, and death was due to cardiac tamponade incident to exploratory needle aspiration.

Two roentgenograms; 1 photograph; 1 drawing.

C. R. PERRYMAN, M.D.
Baton Rouge, La.

Changes in Heart Size in Man During Partial Acclimatization to Simulated High Altitudes. Ashton Graybiel, John L. Patterson, Jr., and Charles S. Houston. Circulation **1:** 991–999, April 1950.

Four healthy young men were partially acclimatized over a period of one month to simulated high altitude in a decompression chamber. During the fourth week the subjects were able to remain at 22,500 feet. The size of the heart shadow on teleroentgenograms was measured at frequent intervals in three of the subjects. In the fourth, exact measurements were impossible because the right heart border was obscured by the shadow of the spine. The authors conclude that the heart shadow decreased slightly in size when the subjects were exposed to reduced atmospheric pressures. They believe that this represented an actual decrease in heart size.

[The chest teleroentgenograms obtained in the decompression chamber were made with a 30-ma. portable apparatus, and therefore the serial roentgenograms were probably not consistently synchronized with the diastolic or systolic phase of cardiac pulsation. The results of this small series are suggestive but require further confirmation.—C. R. P.]

The literature related to the subject is reviewed fairly extensively. C. R. PERRYMAN, M.D.
Baton Rouge, La.

The Value of Miniature Radiography in the Detection of Heart Disease. Arne K. Mathisen, William Morris, and G. B. Wilson. Am. Heart J. **39:** 505–506, April 1950.

In a series of 7,093 4 × 5-inch chest survey films, abnormal cardiovascular shadows were found in 158. On roentgenography with 14 × 17-inch films and clinical examination, 90 of the 158 persons were found to have heart disease, and of these, 33 had been unaware of it. The large number of false positives is attributed to the greater distortion at the short distance (48 inches) used, and to such conditions as sthenic build and pregnancy (causing elevation of the diaphragm), scoliosis, and depression of the sternum.

The same survey disclosed only 22 cases of tuberculosis, 13 of which were active. [This is certainly a powerful argument for having survey films seen by a radiologist instead of a man trained only in tuberculosis.—Z. F. E.]

One table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Recent Advances in the Roentgenographic Diagnosis of Congenital Malformation of the Heart and Great Vessels. Edward B. D. Neuhauser. New England J. Med. **242:** 753–758, May 11, 1950.

It is impossible to do justice to this review in an abstract. The author discusses the congenital abnormalities of the heart and the great vessels and variations of the numerous anomalies. The discussion is extensive in detail and must be studied in its entirety.

The newer procedures and mechanical aids used in the study of cardiac anomalies are discussed. A bibliography of 25 references is appended.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

New Aids in the Diagnosis of Dextrocardia. Carleton B. Chapman and Thomas B. Gibbons. Am. Heart J. **39:** 507–518, April 1950.

Dextrocardia as part of a situs inversus is well known and usually presents no problem. When found as an isolated condition with the abdominal viscera in their usual relationships, it is frequently accompanied by septal defects or obstruction to the pulmonary outflow tract. The authors discuss the means available for studying such a patient's cardiac status.

Electrocardiography is very helpful, especially the unipolar leads, but it is not absolute. Roentgenkymography will determine whether auricles or ventricles are forming the right and left borders by the type of pulsation. Cardiac catheterization will then determine where the right auricle and ventricle are and whether or not any shunts or obstructions are present.

Two cases are reported, one of isolated dextrocardia with no other abnormality and one of mirror-image dextrocardia associated with situs inversus and no intracardiac abnormality.

Two roentgenograms; 2 electrocardiograms; 3 diagrams.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Comparison of Electrokymography and Roentgenkymography in the Study of Myocardial Infarction. Simon Dack, David H. Paley, and Marcy L. Sussman. Circulation **1:** 551–563, April 1950.

Electrokymography is shown to be superior to roentgenkymography in demonstrating the presence of paradoxical pulsation of the ventricular wall. This is to be expected in view of the great magnification possible—up to twenty times that of the roentgenkymogram. Another advantage lies in the possibility of recording simultaneously, by means of a four-channel recorder (see Radiology **53:** 500, 1949), the electrocardiogram, phonocardiogram, carotid or venous pulse tracing, and cardiac apex beat, making possible more reliable identification of the events in the cardiac cycle and more accurate comparison of the pulsation of the various segments of the cardiac borders.

Two cases are presented to illustrate the ease of diagnosis by electrokymography when roentgenkymographs were doubtful. The authors stress that kymographic tracings cannot be accepted as representative of simple volumetric changes within the great vessels or ventricles, since lateral motion is only one component. Rotation, traction, and pendulum movements of the heart are also important factors.

[While this method is undoubtedly a valuable one, it is likely that its usefulness will be in the main in research in view of the complexity of the apparatus.—Z. F. E.]

Two roentgenkymograms; 5 electrokymograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Electrokymographic Studies in Aneurysm of the Left Ventricle. Philip Samet, John B. Schwedel, and Henry Mednick. Am. Heart J. **39:** 749–760, May 1950.

Three cases showing paradoxical pulsation of the left ventricular contour on fluoroscopy and electrokymography are presented. In 2 of these a definite ventricular aneurysm was apparent on x-ray examination. The electrokymographic criterion for a localized area of ventricular damage is the demonstration of systolic expansion or diastolic collapse.

Nine illustrations, including 3 roentgenograms.

Cardiac Catheterization in the Diagnosis of Congenital Heart Disease. H. E. Holling and G. A. Zak. Brit. Heart J. **12:** 153–182, April 1950.

On the basis of an experience of 70 cases representing a wide range of cardiac malformations, supplemented by the results of other workers, the authors attempt to evaluate heart catheterization as a diagnostic method. They append 18 brief case histories to show how the general principles of interpreting results apply in particular instances.

The technic of the procedure is described and the complications are discussed. In 6 of the authors' patients, symptoms and signs indicative of pulmonary or systemic thromboses or emboli developed within two weeks of catheterization, with one fatality.

When no intracardiac shunts are present, and in the absence of patent ductus arteriosus, the oxygen content of the blood in the right atrium should not exceed: (*a*) that of the superior vena cava by more than 2 volumes per cent; (*b*) that of the inferior vena cava by more than 3 volumes per cent; (*c*) the mean of the superior and inferior vena cava by more than 2 volumes per cent. Right ventricular blood oxygen content should not exceed the right atrial blood oxygen by more than 1 volume per cent, and the oxygen content of the pulmonary artery blood should not exceed that of the right ventricle by more than 0.5 volumes per cent.

In *tetralogy of Fallot*, catheterization may serve to demonstrate the pulmonic stenosis (by pressure changes) and permit approximate calculation of the pulmonary blood flow. In a few cases dextroposition of the aorta can be demonstrated by passage of the catheter into it from the right ventricle. It was possible to catheterize the stenosed artery in only one-half of the authors' cases. They believe, however, that in these cases the reduced pulmonary flow is not the sole criterion for operation but that the degree of unsaturation of the arterial blood which is to be shunted into the lungs is equally significant.

In *Eisenmenger's complex*, demonstration of equal systolic pressures in the pulmonary artery and the right ventricle will rule out stenosis.

In *transposition of the great vessels* it can be shown by catheterization that the pulmonary artery contains blood of a higher oxygen content than the aorta. Also, an estimation can be made of the relative amounts of right ventricular and left ventricular blood entering the two great vessels.

In so-called "*pure*" *pulmonic stenosis* there is usually an atrial septal defect, but since the flow is from the right to the left side of the heart, catheterization usually does not reveal any difference in oxygen content. Of those cases with a ventricular septal defect, about half may be diagnosed by the increase in oxygen content on passing from the atrium to the ventricle. Whether the defect is atrial or ventricular, however, is not of great surgical significance. The practical point is determination of the relative volumes of the cardiac output and veno-arterial shunt, for the smaller the shunt the more is valvulotomy to be preferred to systemic pulmonary anastomosis.

Atrial septal defects can sometimes be demonstrated directly by passing the catheter through them. When the catheter cannot be passed through the defect, a comparison of the oxygen content of the vena caval and atrial bloods will reveal the presence of the defect if an arteriovenous shunt occurs, but not if the shunt is veno-arterial. Anomalous pulmonary veins entering the right atrium are occasionally catheterized.

Suggestive evidence of the mitral stenosis which characterizes *Lutembacher's syndrome* is the finding of an unusually high pressure on the right side of the heart in addition to evidence of a left-to-right atrial shunt.

Calculation of the pulmonary blood flow in *tricuspid atresia* will tell if surgery is likely to help. It is not indicated in those patients where the pulmonary artery arises from the left ventricle, as is sometimes the case.

This article is definitely recommended in the original for its large store of very practical information on heart catheterization.

Five roentgenograms; 7 charts; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A New X-ray Technic for Visualization of the Heart and Great Vessels. Ferdinand F. McAllister and Claude S. Beck. Circulation 1: 1049–1051, April 1950.

The technic described by the authors for visualizing the heart and great vessels employs a cardiac catheter fitted with a balloon in a fashion similar to a Miller-Abbott tube. In experiments on dogs such a catheter was advanced into the pulmonary artery under roentgenographic or fluoroscopic control. The balloon was rapidly inflated with 20 to 30 c.c. of air, a film was exposed, and the balloon rapidly deflated. Such films are termed "pneumocardiograms" by the authors. A radiopaque substance can be used to provide contrast when the part to be visualized overlies air-filled lung. During the few seconds of inflation, extrasystoles, temporary bradycardia, or tachycardia may occur. On withdrawal of the catheter, small clots were observed in the folds and rough edges of the balloon. Therefore, until a balloon fitting smoothly into the substance of the catheter is made, this technic is not advised for human subjects.

Six roentgenograms are reproduced, showing the superior vena cava, the right auricle, the right ventricle, and the pulmonary artery. R. JEAN ROMER, M.D.
Baton Rouge, La.

A Case of Congenital Heart Disease. Truncus Aorticus Solitarius, Single Ventricle, and Aberrant Coronary Drainage into the Common Ventricle. A. J. Miller, O. Prec, L. Akman, L. N. Katz, and S. Gibson. Am. Heart J. 39: 607–614, April 1950.

Heart catheterization and angiocardiography were performed on a girl of five and a half years with mild cyanosis and a large aorta demonstrated fluoroscopically, with the aortic knob visible in the postero-anterior view. Catheterization proved that there was functionally, if not anatomically, a single ventricle. Angiocardiography confirmed this finding and established the fact that only one vessel, undoubtedly the aorta, arose from the base of the heart. The descending portion of this truncus aorticus solitarius gave rise to a large artery supplying the left lung. It is assumed that the right lung received its circulation *via* small bronchial arteries. In the process of catheterizing the ventricle, a venous coronary channel was entered (determined by the oxygen content of the blood and the position of the catheter). This is believed to be the first example of aberrant myocardial venous drainage found by catheterization. The patient tolerated both procedures well, and since no surgery was indicated there is no anatomical confirmation for the diagnosis.

[Without surgery or autopsy findings, it seems somewhat rash to pinpoint the diagnosis as the authors have done, since the vessel which they claim as the left pulmonary artery could well be a large bronchial artery. The plain chest film is rather similar to those described by Campbell and Gardner (see abstract on p. 457) in which the pulmonary circulation is provided by the bronchial arteries.—Z. F. E.]

Three roentgenograms; 1 electrocardiogram; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Truncus Arteriosus Communis Persistens. Harold H. MacGilpin, Jr. Am. Heart J. 39: 615–625, April 1950.

In truncus arteriosus persistens there are 5 possible patterns for the pulmonary circulation: (1) pulmonary artery arising in a common trunk with the aorta, with a patent ductus arteriosus; (2) common pulmonic trunk without the patent ductus; (3) right and left pulmonary arteries arising as separate branches from the truncus; (4) one pulmonary artery branching from the truncus, the other lung being supplied by collaterals; (5) no remnants of the sixth arch; both lungs supplied by collaterals.

A case of the fourth type, in a patient who lived to the age of thirty-five, is presented. Plain films were obtained and fluoroscopy was done; the patient was too ill for further measures. The plain films showed a normal hilar shadow and pulmonary vessels on the right side, with practically no vascular markings on the left; the heart was enormously enlarged and the right border of the aorta was seen unusually far to the right of the mediastinum. At autopsy, a large right pulmonary artery was found, branching from the common truncus just above its origin, but the only vessel entering the left lung was a small branch from the aortic arch, measuring 0.6 cm. in diameter, believed to represent a persistent ductus arteriosus.

The literature on the subject is well reviewed.

Four roentgenograms; 3 drawings; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Situs Inversus with Levocardia. A Case Report. Saul J. Robinson and Jack M. Garfinkle. Am. Heart J. **39:** 792–796, May 1950.

A case of situs inversus with levocardia associated with duodenal atresia is reported because, although the condition is rare, it must be considered in the differential diagnosis of congenital cardiac anomalies which are amenable to surgical improvement or correction. X-ray studies, carried out in the present case on the sixth day of life to determine the cause of persistent vomiting, showed the stomach to be on the right side and markedly dilated with gas. There was no gas in the small bowel. The heart was normal in size and location. A diagnosis of duodenal atresia was made. The infant was operated upon, the third part of the duodenum being anastomosed to the first portion of the duodenum and the pyloric portion of the stomach. He withstood the operation well but died two days later, following the development of generalized and pulmonary edema.

Seventeen similar cases have been reported.

One roentgenogram; 2 photographs.

THE DIGESTIVE SYSTEM

Tumors of the Esophagus. C. A. Stevenson. Texas State J. Med. **46:** 234–237, April 1950.

Esophageal roentgenograms should be routinely preceded by a chest study, including fluoroscopy, with search for a fluid level in the esophagus and a soft-tissue tumor. Carcinoma of the esophagus usually involves a short portion of the tube, and spreads by extension laterally into the mediastinum. A sudden transition from normal wall to a narrow, fixed, irregular portion of short length, with an abrupt return to normal at the distal end, is the typical picture. Differential diagnosis of the variants may be more difficult.

Intramural tumors of the esophagus are uncommon. They can consist of any connective-tissue element, but most commonly are lipomas, neurofibromas, or leiomyomas. The roentgenograms in such cases show a unilateral, space-occupying defect which appears to displace the esophagus in one view, but which appears to widen the tube when seen face on. There is an abrupt sharp angle where the tumor meets the normal wall, whereas in the case of an extrinsic tumor the change is gradual. In the face-on view, the widening of the rugae as they fan out over the surface of the tumor and quickly disappear can also be visualized.

Fourteen roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Diagnosis of Lesions near the Cardia. John H. Fitzgibbon. J. A. M. A. **142:** 453–457, Feb. 18, 1950.

Adequate recording of the patient's history, careful roentgen study, and endoscopic examinations when indicated, will make possible an accurate diagnosis in a large majority of lesions near the cardia. One or more of the following symptoms is usually present: dysphagia, substernal distress, regurgitation, heartburn, hemorrhage, weakness, anorexia, and weight loss. Occasionally, however, there are no localizing symptoms. An unsuspected hiatus hernia may be found incidentally.

Roentgen studies of the esophagus and stomach must include both fluoroscopy and roentgenography, in the horizontal as well as in the upright position. Esophageal studies should be supplemented by a chest roentgenogram.

The more common lesions at or near the cardia include congenital stenosis, cardiospasm, diffuse spasm of the esophagus, carcinoma and leiomyoma, hiatus hernia and short esophagus, esophagitis, peptic ulcer, diverticula, varicosities, cascade stomach, foreign bodies, and eventration of the diaphragm. The author summarizes the findings in each of these conditions.

Fourteen illustrations, including 3 roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Polypoid Tumors of Stomach and Colon. Roentgenographic Demonstrations. Ben DuBilier. Texas State J. Med. **46:** 237–241, April 1950.

The roentgenographic signs of polypoid tumor of the intestinal tract are listed by the author as follows: (1) a rounded, central translucent defect; (2) a sharply outlined tumor which splits the flow of barium; (3) possibly considerable mobility of the tumor, depending on length of the pedicle; (4) possible obliteration of mucosal folds over the tumor; (5) erosion of the surface, where bleeding occurs; (6) dimpling of the wall of the tumor when attached to the bowel wall; (7) no interference with peristaltic activity; (8) multiple polyps, often secondary to an inflammatory process, with evidence of irritability, rapid emptying, and loss of haustration.

The following technical details are emphasized: proper bowel preparation, use of mucosal mixtures, compression devices, air contrast, fluoroscopy, and repeated examinations.

Four case histories are included illustrating single, multiple, and multilobed polyps and polypoid manifestations of ulcerative colitis.

Ten roentgenograms; 3 photomicrographs.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Neurinoma of the Stomach. Louis A. Ives. Brit. J. Surg. **37:** 477–478, April 1950.

A case of neurinoma of the stomach is recorded. The patient was a 43-year-old housewife with a history of four or five bouts of hematemesis over the past thirteen years, with no symptoms in the intervals. On admission, at the time of an attack, she was pale and lethargic, with a hemoglobin of 52 per cent. Gastroscopy showed an enormous mass bulging into the stomach from its posterior wall. The mass was covered with rugae and was somewhat irregular. Roentgen examination showed a constant filling defect in the pars media with a central crater. The appearance was consistent with a non-malignant tumor. Operation revealed a mobile mass, "the size of a tangerine," which was covered with mucosa and contained several punched-out shallow ulcers. Histologically the tumor was considered to be neurofibroma of epithelioid type (described by Willis in his *Pathology of Tumours*, 1948). The structure is that of a mass of closely aggregated, short, plump cells, with few or no intercellular fibers, and is easily confused with a leiomyoma. Willis stated that he has seen this histologic formation in only two tumors, both from the stomach.

Five illustrations, including 2 roentgenograms.

R. JEAN ROMER, M.D.
Baton Rouge, La.

Perforation of a Gastric Ulcer Following Intensive Radiation Therapy. William Feiring and Morris L. Jampol. New England J. Med. **242:** 751–753, May 11, 1950.

Following removal of a seminoma of the right testicle, a man of 29 years received (June 2–July 8, 1949) 2,500 r to the right suprapubic and the right lumbar regions and 2,750 r to a right epigastric field (200 kv., 15 ma., 0.5 mm. Cu plus 1.0 mm Al, 50 cm. distance). During the later part of the treatment period a reaction on the skin and a diarrhea developed; six days after conclusion of the radiation, vomiting and abdominal pain occurred, and there was a marked constitutional reaction, with a temperature of 105° F. and pulse of 130. This reaction subsided under conservative treatment. Roentgen examination on Aug. 5 showed a normal appearing stomach and duodenum.

On Sept. 13, the patient experienced a sudden severe abdominal pain with board-like abdominal rigidity and tenderness. Air was demonstrable beneath the right diaphragm, and exploration was immediately undertaken. A 2-cm. perforation was found on the greater curvature of the stomach about 3 cm. from the pylorus. This was closed without difficulty and two months later another study of the intestinal tract showed no evidence of ulcer or other intestinal abnormality.

The authors point out that cytolysis and disorganization of the gastro-intestinal mucosa may be delayed for weeks or months after irradiation. They attribute the earlier symptoms to damage to the intestinal mucosa without perforation.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Diaphragmatic Hernia Following Subdiaphragmatic Vagotomy and Partial Gastrectomy. C. Rollins Hanlon and R. Paul Higgins, Jr. Surgery **27:** 460–464, March 1950.

An interesting and dramatic case report is presented, that of a diaphragmatic hernia which developed after a vagotomy and partial gastrectomy performed transabdominally for chronic gastric ulcer. Technical difficulties were encountered at surgery, which necessitated enlarging the esophageal hiatus to do the vagotomy. Shortly after surgery, symptoms developed resembling hypoglycemia, but this was disproved by chemistry studies. Diaphragmatic hernia was not considered. A short time thereafter symptoms of small bowel obstruction led to roentgen studies revealing the hernia, which contained a portion of the stomach, the Polya anastomosis, a portion of transverse colon, and some loops of upper small bowel. This was repaired surgically. The postoperative course was stormy, complicated by another obstruction (an upper jejunal loop, intra-abdominally) and a subphrenic abscess. Both complications required surgical intervention, and still another visit to the operating room was made to remove a number of infected costal cartilages.

The authors feel that the complications might have been avoided if, after vagotomy, they had closed the enlarged esophageal hiatus as suggested by Dragstedt and others. A warning is sounded that diaphragmatic hernia as a possible complication of vagotomy must be kept in mind.

Four roentgenograms. EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Gastro-Intestinal Manifestations of Porphyria. L. Berlin and R. Cotton. Am. J. Digest. Dis. **17:** 110–114, April 1950.

Gastro-intestinal symptoms are common in cases of porphyria. Severe abdominal cramping pains, constipation, and abdominal distention are frequently encountered. The authors have made a rather thorough x-ray study of the gastro-intestinal tract of a patient suffering with this disease in an attempt to correlate the clinical symptomatology with the pharmacologic and anatomic effect of the porphyrins.

The patient, a 32-year old white male, was serving in the Army in Japan. In 1945, he had an acute gastro-intestinal upset with pain, nausea, vomiting, constipation, and a mild degree of mental depression. All symptoms cleared spontaneously in a short time. Following discharge from the Army in 1946 and return to his prewar job, the patient was nervous, irritable, and dissatisfied. In August 1947, he had an attack of right lower abdominal pain, and a laparotomy was performed. All that could be found at operation was "an incredible impaction of the entire ascending colon." After operation the patient became mentally confused and had to be fed by a Miller-Abbott tube. Eight days after operation he had a "tremendous bowel movement." He experienced numbness of the hands and feet, could eat only a small amount of food at a time, lost weight, and grew progressively weaker. Laboratory examinations revealed a mild hypochromic anemia, a ketosteroid excretion of 7.2 mg., and coproporphyrin excretion of 353.5 gm. in twenty-four hours.

On fluoroscopic examination the esophagus was found to be dilated, there were no peristaltic waves, and emptying was slow. The stomach filled, but there was no peristalsis and no barium was seen to leave the stomach during fluoroscopy. At the six-hour examination the stomach contained only a small residue of barium. It was scattered in the lower ileum, and none had reached the colon. At twenty-nine hours 50 per cent of the barium seen in the six-hour film remained in the stomach and the rest was scattered through the intestine in an irregular pattern. A repeat examination again showed delayed esophageal emptying, but following injection of 1.0 c.c. of 1 to 2,000 prostigmine the stomach was again filled, and 50 per cent of the barium was in the jejunum in one hour.

The patient was given paraminobenzoic acid, choline, and calcium gluconate, and a high caloric diet. He began to improve and left the hospital. His improvement did not continue, however, and at last report his condition was described as essentially unchanged.

Although atony of the esophagus has not been reported before in the literature in a case such as this, there have been numerous reports of large atonic stomachs that did not empty. Constipation and ileus have been commonly reported, together with bouts of diarrhea. It is thought that the disturbance of gastro-intestinal function is due to the toxic effect of the porphyrins on the autonomic nerves.

Seven roentgenograms. JOSEPH T. DANZER, M.D.
Oil City, Penna.

Delayed Gastric Emptying Time in Labor. Lucy A. La Salvia and Elizabeth A. Steffen. Am. J. Obst. & Gynec. **59:** 1075–1081, May 1950.

The authors observed that about 40 per cent of all obstetrical patients vomited either during or im-

mediately following inhalation anesthesia. They also noted that the vomitus often consisted of food ingested several hours prior to delivery. This fact suggested a delay in the emptying time of the stomach during labor and prompted a study of 75 patients from the prenatal clinic. Test meals of carbohydrate, fat, and protein were used, with a barium-water mixture to determine gastric motility by serial x-ray examination.

In this study each patient was submitted to a series of three x-ray studies: (1) test meal with barium; (2) test meal with barium plus sedation (100 mg. demerol and 1/150 gr. scopolamine); (3) test meal with barium and sedation (as above) when the patient was in active labor.

The percentage of gastric retention was determined by the amount of barium present, as well as by evidence of a fluid level in the stomach.

From the results it is concluded that:

(1) Pregnancy alone has little or no effect on the emptying time of the stomach.
(2) Sedation decreases gastric motility.
(3) In labor with sedation a still greater decrease in the motility of the stomach occurs.
(4) In 54 to 72 per cent of all patients in labor with sedation, a fluid level is found in the cardiac end of the stomach from five to eleven hours after the ingestion of the test meal.
(5) There is a delay in gastric emptying time in labor with sedation, regardless of the type of food ingested.

Delay in gastric motility during labor can be explained on the basis of the following factors: (1) Analgesic combinations aid in the delay of food passage from the stomach. (2) The pyloric sphincter has a sluggish reaction time in labor and may not relax at all when the patient is in pain or emotionally upset. (3) Fear and apprehension prolong gastric emptying time.

Incidentally it was observed that, in about 90 per cent of all cases, a greater portion of the small bowel was visualized on the left side of the pregnant uterus, emphasizing dextro-rotation of the uterus in pregnancy.

The delay in gastric emptying time in women in labor under sedation favors vomiting during obstetrical anesthesia. The authors recommend that such complications as aspiration of vomitus be avoided by withholding oral feedings and substituting intravenous therapy during labor.

Five roentgenograms; 3 graphs; 2 tables.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Clinical and Roentgenological Aspects of Prolapse of the Gastric Mucosa in the Pylorus and in the Duodenal Bulb. E. A. Zimmer. Schweiz. med. Wchnschr. **80:** 351–358, April 8, 1950. (In German)

The fact that prolapse of the gastric mucosa through the pylorus into the duodenal bulb in association with other affections of the region of the pylorus is relatively frequent is too little recognized. The clinical findings of this condition mimic ulcer. Roentgen study shows a typical deformity. In the mild case, the fold of mucosa can be seen as a linear filling defect in the pyloric canal. In the next stage, that of unilateral partial prolapse, there is an asymmetrical filling defect of the cap in which one side of the pyloric canal seems to be longer than the other, with a polyp-like head extending into the base of the bulb. If seen in profile the defect is that of a symmetrical polyp-like projection. In the stage of symmetrical total prolapse, the pylorus is elongated in a fashion not unlike that due to hypertrophy of the pyloric muscle. The defect in the cap resembles an umbrella [more commonly termed a mushroom deformity in the American literature]. In reducible prolapse, the fluoroscopic findings may be normal and the defect tends to be variable. In irreducible prolapse the defect is constant and there is often some delay in emptying. Therapy may be conservative if symptoms are slight, but surgical intervention is indicated in the face of a strong tendency to hemorrhage, obstructive symptoms, or pain resistant to treatment.

It is noteworthy that in the presence of positive clinical and roentgenological findings palpation of the stomach at operation or the gross examination of a pathological specimen may not demonstrate any lesion. Many cases of "negative" surgery with "positive" films fall into this group. This peculiarity is probably due to a difference in the contractility of the mucosa and muscle. The syndrome is one to be considered by the practitioner in his differential diagnosis, along with ulcer and gastritis.

Eighteen roentgenograms; 12 drawings.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Primary Carcinoma of Infrapapillary Portion of Duodenum. Thomas A. Shallow, Frederick B. Wagner, Jr., and W. Bosley Manges. Surgery **27:** 348–355, March 1950.

A case of primary infrapapillary carcinoma of the duodenum is reported. The correct preoperative diagnosis was made by roentgen study, which showed a definite constriction in the third portion of the duodenum, with a probable ulcer crater. The authors feel that the reason for the few proved cases of infrapapillary duodenal carcinoma (70) may be that the lesion is considered so rare that it is not looked for or considered. Moreover, in the presence of obstruction, accurate localization is very difficult. They believe, however, that it is possible to make a roentgenologic diagnosis with a higher degree of accuracy than in most of the reported series. When the diagnosis can be established before the superior mesenteric vessels are invaded, or before distant metastases occur, adequate resection, with a good chance for cure, is possible.

Four roentgenograms; 1 photograph; 1 photomicrograph; 1 table.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Para-Aminosalicylic Acid Therapy in Intestinal Tuberculosis. Ivar Källqvist. Am. Rev. Tuberc. **61:** 621–642, May 1950.

The use of para-aminosalicylic acid (PAS) in 22 cases of secondary intestinal tuberculosis is reported. The diagnosis of intestinal involvement in all instances was made by means of barium enema or contrast meal. The drug was administered orally in the form of PAS granulate, which contains 70 per cent PAS. A total of 9.8 gm. of PAS was given daily for periods of approximately three months.

Complete regression of the roentgen evidence of the disease was obtained in 10 cases, with partial regression in 8; no follow-up was obtained in 4. Symptoms were

relieved completely in 13 patients. Five patients died of pulmonary tuberculosis during the course of the study. Seven of 13 patients who did not receive simultaneous collapse therapy during PAS therapy showed regression of pulmonary lesions.

The author stresses the importance of instituting therapy early, before irreversible stenotic changes have occurred in the bowel wall. He feels that in view of the good results in the present series, as well as in previously reported cases, PAS is the treatment of choice in intestinal tuberculosis secondary to pulmonary tuberculosis. He would reserve streptomycin for the more serious and acute pulmonary and general manifestations of the disease.

Twenty-five roentgenograms; 3 charts; 2 tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Typhoid Enterocolitis Simulating Chronic Bacillary Dysentery. Report of a Case with Cure by Chloromycetin. Emanuel M. Rappaport and Eugene O. Rappaport. New England J. Med. **242:** 698–700, May 4, 1950.

The authors present the case history of a patient in whom a dysentery developed in 1945, after immunizing injections for typhoid and paratyphoid fever on induction into the Army in 1942 and "booster" injections of the vaccine every eighteen months while he remained in the service. When seen in 1949, he had had recurrent bloody diarrhea for four years, with intermittent stabbing pain in the right upper quadrant. There had been a 15-pound weight loss since the onset of the diarrhea. Previous rectal examinations and colonic examinations by barium enema had failed to reveal any abnormality.

Proctoscopic examinations at this time showed several irregular patchy areas of granular mucosa in the lower rectum and sigmoid. The submucosal lymph follicles were quite prominent; stool examination showed no amebae but *E. typhosa* was recovered from the swab of the mucosal lesions. Barium examinations of the colon showed some changes suggestive of mucosal ulceration in the sigmoid. When barium was given by mouth, marked segmentation and puddling in the small bowel were seen, with loss of the normal markings. The barium reached the cecum in one hour. The patient was placed on chloromycetin orally, receiving 1 gram every three hours for seven days and then 1 gram every four hours for seven days. Symptoms completely disappeared in about ten days, and a short time later the rectal mucosa appeared normal. After five months a culture of the stool failed to reveal any infecting organism.

The authors point out that the change in the small bowel was in no way indicative of idiopathic ulcerative enteritis, but was somewhat more suggestive of the so-called deficiency pattern.

One roentgenogram.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Gas Cysts of the Intestines (Cystic Pneumatosis). S. O. Freedlander and Samuel S. Teitelbaum. West. J. Surg. **58:** 192–196, April 1950.

Cyst-like collections of gas within the wall of the intestines are known by several names: cystic pneumatosis, emphysema of the bowel, pneumatosis cystoides intestinalis, and gas cysts of the intestines. The condition has been found in both adults and children. In adults the cysts are subserosal, while in children they are mucosal and submucosal.

Cystic pneumatosis is rare in man, though it has long been known to occur in hogs. Many human cases are associated with gastric or duodenal ulcer producing complete or partial obstruction. It has been suggested that in such cases a mechanical blowout may occur, although no satisfactory explanation is given as to why the cysts are seen at a distance from the ulcer. The authors believe that a combination of bacterial, mechanical, and debilitating factors are at work.

The roentgen findings have been described by Lerner and Gazin (Am. J. Roentgenol. **56:** 464, 1946). Gas appears between the liver and the diaphragm and the usual liver shadow may be obliterated by small patches of gas.

Pneumatosis of itself is benign and requires surgical intervention only when it may be a cause of obstruction.

A case is reported of a 62-year-old male who was hospitalized for intractable vomiting and weakness. The radiologists were puzzled by small air shadows over the liver, which, in retrospect they believed represented air in the gas cysts. At operation 120 c.c. of the lower ileum and mesentery were found to be covered with clusters of air cysts. An undiagnosed tumor at the head of the pancreas had caused duodenal obstruction.

One roentgenogram; 1 photograph; 6 photomicrographs.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Solitary Diverticulum of the Cecum. Maurice E. Costin and Eugene A. Gaston. Arch. Surg. **60:** 743–748, April 1950.

Two cases of solitary diverticulum of the cecum are reported, one with and one without inflammatory changes as proved by surgical resection. The roentgen picture is that of a clover-leaf deformity of the cecum, which may clinically be mistaken for carcinoma. Symptoms are variable and may be absent, depending on the presence and degree of inflammation. To date 101 cases have been reported in the literature.

One roentgenogram.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Volvulus of the Small Intestine. Charles B. Ripstein and G. Gavin Miller. Surgery **27:** 506–511, April 1950.

The authors discuss volvulus of the small intestine as a not too uncommon cause of mechanical obstruction of the small intestine and report 6 cases which are illustrative of the clinical, surgical, and radiological aspects. In a twenty-year period at the Royal Victoria Hospital (Montreal) the incidence of volvulus as the cause of bowel obstruction was 6.8 per cent, and the small intestine was involved in nearly half these cases.

Early diagnosis is imperative because of the danger of impairment of the blood supply. The following points should be helpful in arriving at an earlier diagnosis: paroxysms of severe colicky pain associated with vomiting, with intervals relatively free of pain in the early stages, and increase of severity of symptoms with no free intervals as the process continues. Abdominal distention is usually not marked but tenderness is commonly present. Discomfort in the

supine position and attempts to seek a "position of relief" favors a strangulated obstruction. The radiologic findings are variable but usually show evidence of small bowel obstruction and, in about half the cases, an arrangement of distended small bowel loops in an "arcade" pattern, which is suggestive of volvulus.

Six illustrative cases are reported.

One roentgenogram; 1 photograph; 3 tables.

RICHARD A. ELMER, M.D.
Emory University School of Medicine

Volvulus of the Colon. Walter H. Gerwig, Jr. Arch. Surg. 60: 721–742, April 1950.

Volvulus—a torsion of an intestinal segment—is more common in Europe than in the United States, the ratio being 40 to 7 per cent; however, the small bowel is more commonly involved in this country, while large bowel volvulus is more common in Europe. The ratio of sigmoid volvulus to cecal volvulus is 2:1. Factors predisposing to volvulus of the colon are (*a*) elongation of the mesentery with a freely mobile bowel; (*b*) absence of a mesentery with a mobile bowel; (*c*) closely approximated points of fixation of the bowel; (*d*) limbs of bowel close together. High residue diet, trauma, purgation, over-exertion, and heavy eating have been accused as exciting factors. Pathologic changes are a closed loop obstruction, with circulatory impairment. Classification is based on the degree of torsion and the amount of irreversible damage. Details of 8 cases are given, 5 in the sigmoid and 3 in the cecum.

It is noteworthy that the symptoms of cecal volvulus are those of a low small bowel obstruction, while those of a sigmoid volvulus are of a large bowel obstruction. A scout roentgenogram of the abdomen may reveal only the distended closed loop of distorted bowel and some dilatation of the small bowel. A barium enema study will usually show little more than the site of obstruction and may be a rather dangerous procedure from the standpoint of possible perforation.

Surgery is usually indicated, but in very mild asymptomatic cases discovered incidentally on roentgen study, treatment may be omitted. In general, primary resection and anastomosis are preferable in elective cases; in the presence of gangrene, exteriorization and resection are mandatory.

Seven roentgenograms, 3 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Intussusception Associated with Aberrant Pancreatic Tissue. Report of a Case and Review of the Literature. John L. Keeley. Arch Surg. 60: 691–698, April 1950.

A three-and-a-half-year-old white boy had an obstructive lesion which proved to be a compound intussusception, ileocolic and ileoileal. A barium enema reduced the colonic portion, but the ileum remained intussuscepted in the ileum as seen on the films. At operation the intussusception was reduced and, because of the poor condition of the bowel, resection of about 22 cm. was done, including a small nubbin which formed the head of the invagination. Microscopic study showed this to be pancreatic tissue. The child recovered and remained well.

One roentgenogram, 2 drawings, 2 photomicrographs.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Heterotopic Pancreatic Tissue. Report of a Case Presenting Symptoms of Ulcer and Review of the Recent Literature. J. Max Busard and Waltman Walters. Arch. Surg. 60: 674–682, April 1950.

Since the comprehensive survey of Barbosa *et al.* (Surg., Gynec. & Obst. 82: 527, 1946) 28 new cases of pancreatic heterotopia have been reported and, in addition, the present authors have found 43 earlier cases overlooked in the previous study. The case here reported brings the total count to 543. These are distributed as follows: stomach, 149; duodenum, 159; jejunum, 85; ileum, 32; Meckel's diverticulums, 30; gallbladder, 15; miscellaneous, 73.

This authors' patient was a 59-year-old white man with epigastric and left upper quadrant pain of three years duration. He had long suffered from an "acid condition" of the stomach, relieved by soda. Eighteen years before, his physician had diagnosed duodenal ulcer, pylorospasm, and a "spot" on the stomach observed roentgenologically. These findings were confirmed by x-ray studies five months before entry and again after entry. The preoperative diagnosis was leiomyoma, but a malignant tumor could not be excluded. At operation the tumor was found on the greater curvature, and a segmental resection done. Careful exploration of the open duodenum failed to demonstrate an ulcer. Pathological study showed a pancreatic rest (so-called adenomyoma) with two mucosal diverticula. The patient was relieved of his symptoms and continued well for the brief follow-up period (two and a half months).

One photomicrograph; 1 table listing the reported cases not included by Barbosa *et al.*

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Mesenteric Cysts. Report of Three Cases, in One of Which a Calcified Cyst Was Present. W. Emory Burnett, George P. Rosemond, and Robert M. Bucher. Arch. Surg. 60: 699–706, April 1950.

Three cases of mesenteric cyst are reported. One was symptomatic, in one the relation between symptoms and the cyst was doubtful, and one was asymptomatic. The classical picture is that of a low-grade intestinal obstruction and a freely movable abdominal mass. The condition is about twice as frequent in women as in men, and there is no characteristic age distribution. Pain, nausea, vomiting, and constipation are usual findings. In one case reported here, a roentgenogram showed calcification in the cyst.

Since a clinical diagnosis cannot be made with certainty, an exploratory operation is necessary for confirmation of the diagnosis and for treatment; elective removal is preferred and generally feasible. As the resection may compromise the blood supply to a segment of bowel, it is sometimes necessary to do, in addition, a partial bowel resection.

Five tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Anomalies of the Gallbladder. Report of a Case of Left-Sided Floating Gallbladder. Charles W. Mayo and Douglas B. Kendrick, Jr. Arch. Surg. 60: 668–673, April 1950.

This report concerns a 56-year-old white woman with the clinical picture of cholecystitis and cholelithiasis. At operation the gallbladder was found on the left

floating freely, with a small posterior mesentery. It contained a single stone, and emptied into the common duct. The gallbladder was removed. Some discussion of gallbladder anomalies is given.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Acute Gaseous Cholecystitis. John F. Gowdey and N. Newell Copeland. New England J. Med. **242:** 647–650, April 27, 1950.

A 57-year-old male entered the hospital with severe upper abdominal pain, nausea, and vomiting. He gave a five-year history of abdominal discomfort, especially after eating fried and greasy foods. There was upper abdominal distention with tenderness and spasm and rigidity of the right rectus muscle. There was no jaundice but there were a slight elevation of temperature and a leukocytosis of 23,000. Immediate x-ray examination showed no opaque calculi, no evidence of obstruction, and no free air or gas beneath the diaphragm. Two days later, a cholecystographic examination showed the opaque medium within the stomach and a pear-shaped collection of gas in the upper right quadrant, suggesting a gas-filled gallbladder. A barium swallow showed no abnormality of the esophagus or stomach. Only a small amount of barium was seen to leave the stomach, and the upper intestinal tract was ruled out as the gas-filled area. The patient was operated on and the gas-filled gallbladder was removed. A stone was found impacted in the cystic duct.

The authors review the literature on gaseous cholecystitis. The condition is believed to arise from gas-forming bacteria present in a gallbladder in which an acute obstruction occurs, resulting in increased gas formation and devitalization of the gallbladder walls.

Radiographic findings are distinctive and characteristic. A gas shadow is seen in the upper right quadrant, conforming in size, shape, and position to the gallbladder. At times, gas can be seen in the various planes of the gallbladder wall. In a film taken in the upright position a fluid level will be found which distinguishes this condition from an internal biliary fistula. At times, a stone will be visualized in the gallbladder. A barium enema study should be performed, as should also a barium examination of the upper gastro-intestinal tract. Intubation of the upper gastro-intestinal tract may be a necessary procedure.

Four roentgenograms. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Hepatic Amebiasis with Complications. John Day Peake and Marshall Eskridge. South. M. J. **43:** 300–306, April 1950.

Hepatic amebiasis is of much more frequent occurrence than is generally taught. The authors state that there were no reports of the condition in the Year Book of Radiology from 1932 to 1941. It has been reported more frequently in recent years. Fluoroscopic and radiographic examinations should indicate the diagnosis in from 80 to 90 per cent of the cases.

The following findings may be apparent radiographically and fluoroscopically: (1) elevation of the right diaphragm if the abscess is in the left lobe; (2) fixation of the right diaphragm, particularly if the abscess is near the dome; (3) obliteration of the cardiophrenic angle; (4) enlarged tender liver; (5) right basal pulmonary abnormality with patchy pneumonitis, atelectasis, or fluid; (6) bulging of the diaphragm if the abscess is pointed; (7) displacement of the barium-filled duodenal cap and cardia of the stomach. Aspiration of the abscess cavity and replacement of the contents with air or an opaque medium may prove useful.

Endameba histolytica is found in the stools of only 10 to 70 per cent of patients who have amebic abscess. Hepatic amebiasis may occur as early as one week after the acute onset of diarrhea or as late as ten to fifteen years after the primary infection. Ochsner believes that treatment is indicated if a patient is found to have characteristic x-ray and clinical findings of amebic hepatitis even in the presence of negative stools.

The authors present 7 case histories and stress the significance of early diagnosis by radiographic examination.

Six roentgenograms; 1 photograph.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

THE MUSCULOSKELETAL SYSTEM

Fibrous Dysplasia of Bone. Lyle W. Russell and Fremont A. Chandler. J. Bone & Joint Surg. **32-A:** 323–337, April 1950.

This paper reviews 10 cases of fibrous dysplasia of the bone, including monostotic and polyostotic forms, and 1 case of Albright's syndrome. Most commonly a long bone was involved. There was usually pain of varying severity and pathological fracture occurred in 5 cases. Blood and urine studies showed no consistent abnormalities.

The roentgenographic appearance was that of a cystic or ground-glass area in one or several bones, with no surrounding zone of sclerosis. In some instances the bone was expanded and the cortex thinned. Biopsy was done in all cases. Microscopically, the lesions were of two main types: ossifying and non-ossifying. Both types exhibited masses of fibrous connective tissue, composed of spindle cells arranged in whorls or strands, replacing normal cortical and cancellous bone and marrow.

A diagnosis can sometimes be made on the basis of the clinical and roentgen findings but biopsy is often necessary. The polyostotic lesion may simulate hyperparathyroidism but this can be differentiated on the basis of the blood calcium and phosphorus. Monostotic fibrous dysplasia may be confused with simple bone cyst and there is some belief that these conditions are related. Giant-cell tumor will be differentiated from the pathological picture. Osteogenesis imperfecta occurring in infancy is usually easily differentiated but the type that occurs later in life may be confusing. The roentgenographic examination reveals generalized osteoporosis, usually with some degree of bowing, in osteogenesis imperfecta, as contrasted with the spotty distribution of either cystic-appearing lesions or the ground-glass appearance of fibrous dysplasia.

The etiology of this condition is unknown. The pathogenesis is discussed, as are also the indications for treatment.

Twelve roentgenograms; 8 photomicrographs; 2 photographs; 1 table. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Sarcoma in Paget's Disease of Bone. Irving E. Miner. Bull. Hosp. Joint Dis. **11:** 26–42, April 1950.

The incidence of malignant change arising in Paget's disease of bone is usually given as 10 per cent, but

accurate figures are impossible to obtain, since many cases of Paget's disease are completely symptomless and are found only in the course of x-ray examination for other reasons. Three different types of sarcomatous change are seen—fibrosarcoma, osteogenic sarcoma, and malignant giant-cell tumor. Coley believes that the sarcoma arising in Paget's disease is different from true osteogenic sarcoma and suggests that it be designated as Paget's sarcoma.

The diagnosis may be suspected when a patient with Paget's disease complains of persistent severe pain. X-ray examination shows an area of destruction in the thickened coarse bone characteristic of Paget's disease. Blood alkaline phosphatase levels are elevated in Paget's disease but are not directly affected by the occurrence of malignant change. Biopsy is essential for a definite diagnosis.

The author reports 8 proved cases of sarcoma developing in Paget's disease, bringing the total in the literature to 65. One case in his series had a multicentric origin while the others arose in a single focus. As in any sarcoma of bone, the prognosis is poor.

Nine roentgenograms; 2 photomicrographs; 4 photographs; 1 table. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Paget's Disease Complicated by Multiple Myeloma. Charles M. Hanisch. Bull. Hosp. Joint Dis. **11:** 43–47, April 1950.

Since malignant changes in bones affected by Paget's disease would be assumed to be sarcoma, it is well to know that multiple myeloma can also complicate Paget's disease. [This is of more than academic interest, since multiple myeloma is more susceptible to treatment than sarcoma. Stilbamidine and other chemicals as well as irradiation may give relief in multiple myeloma.]

A single case is reported, with lesions of myeloma in the skull and sixth right rib and both myeloma and Paget's disease in the lumbar spine and pelvis. Serum protein was elevated but Bence-Jones protein was not found in the urine. Sternal puncture was non-diagnostic, so the rib lesion had to be explored before the diagnosis was certain.

Four roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Aneurysmal Bone Cyst. Henry L. Jaffe. Bull. Hosp. Joint Dis. **11:** 3–13, April 1950.

Twenty cases of a peculiar type of bone cyst are presented and analyzed. The majority of the tumors were in long bones, eccentrically placed (near the ends but generally sparing the epiphyseal portion), or in the vertebrae. Most of the patients were young adults and older children. Pain (not severe) and swelling were the chief complaints. X-ray examination showed a ballooned-out expansion of the periosteum outlined by a very thin shell of bone. The underlying cortex is thinned, raising the suspicion of a malignant neoplasm if one is unfamiliar with this type of cyst.

At operation, the cyst is found to be subperiosteal and filled with liquid blood. The lining tissue is scant, being composed mostly of vascular channels and a little connective tissue. The microscopic findings are not characteristic, and the author is not sure that these cysts represent an entity, postulating that they may arise as different processes, with hemorrhage destroying the identity of the original lesion.

Treatment consists of curettage and packing with bone chips.

Five roentgenograms; 3 photomicrographs; 1 photograph. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Calcified Islands in Medullary Bone. Howard Haldeman Steel. J. Bone & Joint Surg. **32-A:** 405-412, April 1950.

This is a study of the solitary, asymptomatic, irregular, radiopaque, sclerotic bone islands sometimes seen in the cancellous tissue at the ends of long bones. They are homogeneous in density and vary from 0.5 to 7.5 cm. in diameter. In a review of 6,000 roentgenograms, 120 calcified islands were found in the various bones, most frequently in the femoral neck and condyles, the iliac wings, proximal portion of the tibia, and head of the humerus. The etiology of the condition is not definitely established, but 27 per cent of the lesions were found in patients suffering from blood-vessel abnormalities. The possibility of a bone infarction is strongly considered.

In differential diagnosis, osteopoikilosis, osteoid osteoma, osteogenic sarcoma, metastatic lesions, chondrodysplasia, bone infarct, and caisson disease must be considered.

Two case histories are given. One patient, who died of advanced tuberculosis, was found to have a bone island in the right femoral neck. This was removed at autopsy and microscopic section showed an external fibrous coat over a shallow layer of new bone which was undergoing ossification. A nest of young cartilage cells was present. In the center, an area of excavation was found which was lined with necrotic bone undergoing resolution.

In the second case a mid-thigh amputation was done for diabetic gangrene. A solitary calcified medullary defect measuring 2.5 × 3.5 cm. was found in the distal portion of the femoral shaft. On microscopic section this showed an outer fibrous cover over a layer of new bone undergoing sclerosis. Young cartilage cells were also found. In the center of the lesion, necrosis and repair were in progress.

Eleven roentgenograms; 4 photomicrographs; 2 tables. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Cystic Tuberculosis of Bone Complicated by Tuberculous Meningitis. Eugene R. Kutz, Stanley H. Macht, and Robert S. Easton. J. Pediat. **36:** 550–566, May 1950.

Eighteen cases classified as cystic tuberculosis of bone are said to have been reported since 1928. In 83 per cent of these patients there was involvement of the long bones of the upper extremities and in 38 per cent lesions were present in the long bones of the lower extremities. Two-thirds of the patients gave positive tuberculin tests and evidence of intrathoracic lymph node or pulmonary involvement. Two cases of multiple cystic bone tuberculosis complicated by tuberculous meningitis are reported here.

One patient was an 11-month-old Negro girl who had swelling and tenderness of the left foot and right hand. Roentgen studies revealed a large cystic and expansile lesion of the third metacarpal of the right hand with periosteal reaction along the shaft. There were radiolucent areas in the calcaneus and first metatarsal bones of the left foot and a cystic area in the metaphysis

of the right tibia. The mediastinal shadow was widened, with a deviation of the trachea to the right and an infiltration in the right upper lobe was present. Symptoms and signs of meningitis developed. Treatment with streptomycin and promizole resulted in a healing of the bone, chest, and meningeal lesions.

The other patient was a 21-month-old Negro girl. Her present illness began five months previously, when two weeks following a fall she guarded all movement of her right arm. Subsequent roentgen examinations revealed bilateral pulmonary tuberculosis with atelectasis of the entire left lung. There were cystic lesions of the left first metacarpal and right carpal bones. Signs of meningitis later developed. Following treatment with streptomycin and promizole, the pulmonary, osseous, and meningeal lesions improved. The signs and symptoms of meningitis recurred but were again controlled by streptomycin.

Thirty-five roentgenograms; 3 tables.

HOWARD L. STEINBACH, M.D.
University of California

Pseudohypoparathyroid Tetany. H. Bakwin, W. F. Gorman, and S. R. Ziegra. J. Pediat. **36:** 567–576, May 1950.

A total of 9 cases of pseudohypoparathyroidism have been reported [For a tenth case, see Lowe et al.: J. Pediat. **36:** 1, 1950. Abst. in Radiology **55:** 786, 1950.—Ed.] The clinical picture of this disease is distinctive. It includes (1) symptoms and signs of tetany, namely convulsions, carpopedal spasm, laryngeal spasm, positive Chvostek and Trousseau sign; (2) alterations in body configuration reminiscent but not typical of achondroplasia, as short stature, sturdy build, rounded features, irregularities in the length of metacarpals and metatarsals; (3) areas of calcification in the soft tissues. The characteristic changes in the blood are reduction in the serum calcium and elevation of the inorganic phosphorus, the alkaline phosphatase remaining unchanged. These patients fail to respond to injection of parathyroid extracts with an increase in the urinary output of phosphorus and an elevation of the serum calcium as do normal individuals and patients with true hypoparathyroidism. It is this feature which led Albright to conclude that the metabolic defect is an insensitivity of the receptors to parathormone. The treatment of choice is vitamin D in high doses combined with orally administered calcium.

A case is reported in a 16-year-old girl with the following roentgen findings: The skull was thickened throughout. The ulnae and radii were broad and gnarled, and the fibulae were bowed inward, with subperiosteal reinforcement. The metacarpals were deformed, the distal ends of all except the first showing sharply demarcated areas of decreased density such as are seen in chondrodystrophy. They were short and broad, with the exception of the second on the right and the third on the left. The first phalanx of the third finger on the left was long. The second metatarsals were unusually long. The phalanges of the feet were distorted as in chondrodystrophy. Soft-tissue calcification was not observed. There was considerable resorption of the apices of almost all of the teeth.

Four roentgenograms; 4 photographs; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

Plasmocytoma (Myeloma): Histopathology and Radiologic Picture. Roberto D'Alò. Radiol. med. (Milan) **36:** 273–288, April 1950. (In Italian)

The author reports on the cases of myeloma observed at the Cancer Institute at the University of Milan and includes in his article illustrative cases previously published by Garland and Kennedy (Radiology **50:** 297, 1948) and Cutler, Buschke and Cantril (Surg., Gynec., & Obst. **62:** 918, 1936). From the study of his own cases and from a review of the literature the author states that about 25 per cent of the solitary myelomas remain solitary over a period of four years, while about 35 per cent generalize within a period of two years. This is important from the standpoint of treatment, for, since at least some of these tumors do not become multiple, surgery and x-ray therapy may be indicated, and the solitary type should be relatively more benign than the multiple. As far as the diagnosis of myeloma is concerned, the experience of the author is that, while multiple myeloma is not difficult to recognize from a radiological standpoint, the solitary lesion may simulate many other inflammatory or neoplastic conditions.

Nineteen roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Metastatic Tumours of Bone. Pathological Aspects. S. L. Baker. **Diagnostic Aspects.** F. Campbell Golding. **Endocrine Aspects: Relationship of the Steroid Hormones to Cancer.** A. C. Crooke. **Radiotherapeutic Aspects.** G. W. Blomfield. J. Faculty Radiologists **1:** 245–266, April 1950.

The radiographic appearances of bone tumors are largely dependent upon the reactions of the surrounding bone, and these Baker lists as (1) no effect, (2) bone absorption, and (3) bone deposition.

Golding considers experience, unfortunately, the most important single factor in differentiating primary and secondary bone lesions. He presents multiple charts demonstrating the percentage of metastases to bone and lungs from various primary sites and includes roentgenograms of various metastatic lesions.

The mechanism of hormone influence in cancer is still not understood, but most evidence suggests that the action of the steroid hormones is not specific but is associated with their normal physiologic function. Treatment with hormones, then, according to Crooke, should aim at the greatest possible sex reversal in the shortest possible time and maintaining this condition until relapse occurs. It may then be possible to obtain a further remission by again reversing the hormone balance.

The radiotherapeutic aspects of bone metastases from various types of primary tumors are discussed by Blomfield. Radiation therapy was found to be of value for palliation in more than 50 per cent of a series of tumors metastatic from the breast. Careful selection of cases is necessary for good results and supervoltage therapy is considered advantageous. Treatment of generalized bone metastases by radiotherapy is seldom of use, but radioiodine appears to be of definite value for the functioning secondaries of thyroid adenocarcinoma. Numerous case reports of bone metastases are included.

Twenty-three roentgenograms; 4 photomicrographs; 4 charts; 4 tables.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Genital, Extragenital and Skeletal Granuloma Inguinale. Report of a Case. Robert G. Lipp and Douglas E. Bibby. West. J. Surg. **58:** 173–177, April 1950.

Granuloma inguinale may be associated with extragenital or visceral lesions. That the disease is spread by the blood stream is almost universally accepted.

The case reported here is that of a 20-year-old female with genital and inguinal soft-tissue lesions and multiple bony involvement. In each radius there were irregular mottled areas of decreased density associated with moderate periosteal reaction and soft-tissue swelling, and the right tibia was the site of an osteolytic lesion. Donovan bodies were isolated from the tibial, inguinal, and labial lesions. The response to streptomycin was gratifying.

Ten illustrations, including 6 roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Tomography and Its Application to Investigations of the Spine. J. H. Middlemiss. J. Faculty Radiologists **1:** 273–298, April 1950.

The introduction to this article gives a good history of the development of body section roentgenography. Technical considerations are discussed, including present methods, applications, and limitations of this specialized radiographic examination. Anatomical features in the examination of the spine are considered, the author being of the opinion that many diseases of the spine can be better diagnosed and their progress followed by the use of tomograms.

Clinical applications of tomography in examination of the spine include cases of tuberculosis, juvenile and adolescent osteochondritis, Calvé's disease, chondro-osteodystrophy, spondylitis ankylopoietica, neoplasms, and poorly defined fracture cases.

The author feels that the procedure should be used only when the radiologist has a full understanding of the problems confronting him. When further information of diagnostic value is likely to be forthcoming from this investigation, which cannot or is unlikely to be provided by standard procedure, the indications for its use would seem to be: (1) to establish a diagnosis when that has not already been achieved; (2) to produce an adequate demonstration when, owing to the anatomical site, this cannot be accomplished by standard technic; (3) to define the full extent or the progress of a lesion; (4) to demonstrate whether or not activity still exists in a disease process.

Twenty-six illustrations, including 18 roentgenograms.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

An Evaluation of Myelography in the Diagnosis of Intervertebral-Disc Lesions in the Low Back. Lee T. Ford and J. Albert Key. J. Bone & Joint Surg. **32-A:** 257–266, April 1950.

It had formerly been the practice of the authors to make a diagnosis of intervertebral-disk lesion from the history, physical examination, and plain roentgenograms of the spine. In September 1946, myelographic studies were begun, and an attempt is made to correlate the myelographic and operative findings. A discussion of the technic of myelography and the interpretation of the various factors and appearance of the opaque column is also presented.

In a series of 253 myelograms defects indicating an intervertebral-disk lesion were noted in 201 cases. In 206 patients, the canal was explored (167 with myelographic evidence of a disk lesion; 39 with normal myelograms). In 149 cases (137 with positive findings and 12 with negative findings), the myelographic diagnosis was confirmed. Of the remaining cases, 27 with negative myelograms showed protruded disks at operation; 10 showed a disk lesion at a different level than was indicated myelographically; 3 in which the myelogram indicated a defect proved normal at operation, while in 17 minor discrepancies occurred. The total discrepancy therefore between the findings on myelography and operation was 27.7 per cent. Some of these discrepancies can be accounted for by the authors but there is a group that cannot. This is especially true of the false positives.

Since the accuracy of this examination in the authors' hands is only 73.2 per cent, they are more inclined to depend upon the history, physical findings, and other laboratory work, than to rely entirely upon the myelogram. When myelography is done, it is only after a diagnosis has been established and then solely for confirmation. If an operation is indicated by the history and physical findings, it is performed in spite of a negative myelogram. The authors admit that the procedure may be of great help in establishing the location of the lesion and in the handling of the neurotic type of patient.

Eighteen myelograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Prognosis in Idiopathic Scoliosis. Ignacio V. Ponseti and Barry Friedman. J. Bone & Joint Surg. **32-A:** 381–395, April 1950.

A review of 394 cases of idiopathic scoliosis which were not treated surgically was undertaken to determine the ultimate outcome of conservative treatment. Four main factors were found to be of significance in determining the prognosis of curvature. These were: (1) the pattern of the curve; (2) the age of the patient at onset; (3) the change in density of the vertebrae and abnormalities of the disk spaces; (4) rapidity of increase in the size of the curve. The prognosis in the main lumbar, thoracolumbar, and cervicothoracic curves is usually favorable, while the prognosis for combined thoracolumbar curves was usually good if they developed after ten years of age, but poor if they developed earlier. As a whole, the main thoracic curves increased to greater deformities than the others. The most deforming curves originate in early life. Scoliosis developing later in adolescence has a better prognosis. It is noted that the curve pattern usually does not change throughout the course. The curvature ceases to progress about one year before ossification is complete.

Roentgenograms of the vertebrae and the intervertebral spaces often showed changes in the texture of the bone and abnormalities in the disk spaces. Most of these changes were apparent in the thoracic curves shortly after the onset of the scoliosis. The lumbar vertebrae usually showed little alteration in texture.

Rapid increase in the curve, as noted on repeated roentgenograms, is a sign of poor prognosis. This rapid change may occur at the onset or sometimes right after the onset of the curvature.

Twenty-four roentgenograms; 6 photographs; 1 chart; 2 tables.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Radiation Scoliosis. An Experimental Study. Alvin M. Arkin and Norman Simon. J. Bone & Joint Surg. **32-A:** 396–401, April 1950.

A radon seed of 0.6 millicurie was implanted adjacent to the epiphyseal plate of a lumbar vertebra of a young rabbit, resulting in a dosage of 2,700 gamma roentgens. This was sufficient to suppress growth at this area but permitted growth to develop on the opposite side of the vertebra and in the adjacent vertebral epiphyseal plates. A definite scoliosis developed.

A similar scoliosis was produced in another rabbit by roentgen irradiation (140 kv., 20 ma., 30 cm. distance, 0.25 mm. copper plus 1 mm. aluminum filtration) to a field 1 × 7 cm. over the dorsum of the animal. A dose of 1,000 r was delivered to the epiphysis at a single sitting. The beam was checked radiographically. After a period of seven weeks, scoliosis with wedging was demonstrated on the irradiated side of the vertebral column. The rabbit was subsequently sacrificed and definite decrease in the height of the vertebrae was noted on the irradiated side.

The scolioses in these irradiated animals were due to the direct action of the radiation on the epiphyseal plate. That they could not be attributed to pressure from contractural scarring in the concavity of the curve is indicated by the fact that the intervertebral disks were wider on the irradiated side, due to an attempt at functional correction of the scoliosis.

It is suggested that the direct unilateral suppression of epiphyseal growth, by production of wedging in a predictable area, may be applicable clinically.

Nine roentgenograms; 2 photomicrographs.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Radiation-Induced Scoliosis. A Case Report. Alvin M. Arkin, George T. Pack, Nicholas S. Ransohoff, and Norman Simon. J. Bone & Joint Surg. **32-A:** 401–404, April 1950.

The authors present the history of a 13-year-old girl who had shown multiple melanomata of the back in infancy. By the time she was nineteen months old at least 25 of these neoplasms had been excised. At that age a large mass was felt in the left side of the abdomen and was diagnosed as a Wilms' tumor. Preoperative irradiation was given over anterior, lateral, and posterior fields in the left abdomen, for a dose (in air) of 1,100 r each, at 198 kv., 50 cm. distance, 0.5 mm. copper filtration. One month later the tumor was excised. The histologic diagnosis was embryonal adenocarcinoma, Grade 3. Postoperative irradiation was begun three months after excision, 2,100 r being given to each of three fields, with similar irradiation factors. At the age of nine years a marked scoliosis of the dorsal lumbar region had developed, and there was also inequality in length of the lower extremities. At thirteen years, examination showed scoliosis of the lumbar spine convexly to the right, with shortening of the lower extremity, club foot on the left, and multiple nevi of the skin of the back. A roentgenogram of the lumbar region showed scoliosis with the concavity to the left, with uniform wedging of the lumbar vertebrae on the left. The left ilium was smaller than the right and the left 12th rib was considerably smaller than its fellow on the opposite side.

The authors believe that the scoliosis in this case was induced by the irradiation, since the curvature was confined to the lumbar region within the range of the irradiation, with inhibition of the growth of the left half of the vertebral bodies, the left 12th rib, the left lumbar transverse process, and the left ilium. These changes differ from those of the usual idiopathic scoliosis.

Three roentgenograms; 3 photographs.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Synovial Osteochondromatosis of the Shoulder. Alexander E. Brodsky. Bull. Hosp. Joint Dis. **11:** 14–25, April 1950.

Synovial osteochondromatosis is a relatively uncommon lesion occurring most frequently in the knee and, with decreasing frequency, in the elbow, hip, ankle, and shoulder. It is believed by the author to represent a self-limited metaplasia of the synovium and not a true neoplasm. The joint bodies are originally suspended by a pedicle from the synovium but later are free. If they are small, they may be caught between the articulating surfaces during joint motion and cause considerable pain.

Two cases are presented. In one case the bodies were small and were removed at operation. They presented in four separate clusters. Good range of painless motion was obtained. In the second case two examinations were available with a ten-year interval since surgery was refused. Here the bodies were larger and it seems unlikely that they could get between the humerus and scapula. As in the first case, they were grouped in clusters. Increase in size and density but not in number occurred in the ten years. Some hypertrophic changes had developed and pain had become more troublesome, but the patient had practically no disability.

Eight roentgenograms; 2 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Coracoclavicular Joint. A Rare Condition Treated Successfully by Operation. F. J. S. Hall. Brit. M. J. **1:** 766–768, April 1, 1950.

Coracoclavicular joint is a rare anomaly in which a bony process extends downward from the clavicle to articulate with the coracoid process. A case is reported by the author in which the roentgenogram showed the anomalous articulation on the right side, though it was not realized that the clavicular outgrowth actually articulated with the coracoid process until operation was undertaken. This demonstrated an actual joint lined with articular cartilage. Results of treatment were satisfactory.

Only 54 cases were found in the world literature by the author. Most of these had been asymptomatic. In 4, including the one here recorded, surgery was required for relief of the intolerable pain.

Three roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Ossification of the Metacarpal and Metatarsal Centers as a Measure of Maturation. Doris H. Milman and Harry Bakwin. J. Pediat. **36:** 617–620, May 1950.

Todd (Atlas of Skeletal Maturation, St. Louis, C. V. Mosby Co., 1937) has pointed out that at all ages, primary ossification centers (carpals and tarsals) show considerably more variation than secondary centers, with the exception of the capitate and hamate bones,

which ossify within the first three or four months of life. He concluded that the epiphyses of the metacarpals, metatarsals, and phalanges are the most useful ones for determining bone age under six years. The authors' analysis is based upon the data of Francis and Werle (Am. J. Phys. Anthropol. **24:** 273, 1939), who studied 307 boys and 315 girls and recorded the number and percentage showing the various centers at certain age intervals from birth up to five years.

At one year of age about 50 per cent of girls show ossification of the center for the second metacarpal and only 8 per cent have an ossified center for the first metacarpal. In only 4 per cent of the cases is there a metatarsal center. At two years of age practically all girls have all of their metacarpal centers and 60 per cent have the second metatarsal epiphyses. At three years of age only the center for the fourth metatarsal remains unossified in a significant percentage of cases, and at four and a half years all of the bones under consideration are ossified in 100 per cent of girls. The appearance of these centers in boys occurs from six to thirteen months later than in girls.

Two drawings; 2 tables.

HOWARD L. STEINBACH, M.D.
University of California

Acute Pain in the Wrist and Hand Associated with Calcific Deposits. Report of Fifteen Cases. Harold Seidenstein. J. Bone & Joint Surg. **32-A:** 413–418, April 1950.

The condition of painful wrist and hand with calcific deposits, similar to those found about the shoulder, is not frequently discussed, but the author reports 15 cases. In 8 the deposits were on the ulnar side of the wrist, in 5 on the radial side, and in 2 in the palm, in the region of the metacarpophalangeal joints. Clinically the pain is severe and acute, and in most cases of sudden onset, with induration and tenderness over the involved area. The hand is usually held perfectly still because of the pain. Radiographically, calcific deposits measuring from 3 mm. to 2 cm. are demonstrable in the soft parts. None of the author's patients were treated by incision, but it is speculated that the calcifications lie within the peritendinous soft tissue, such as a tendon sheath, bursa, or ligament.

The etiology of this condition is obscure. A relationship to vitamin E deficiency has been suggested. Treatment consists in narcotics to relieve the pain and immobilization of the hand and forearm in plaster. The immobilization usually relieves the pain and can be removed in seven to ten days.

The author groups his cases into: (1) deposits along the course of the flexor carpi ulnaris, near the pisiform; (2) deposits along the course of the flexor carpi radialis near the greater multangular; (3) deposits on the palmar aspect of the hand near the head of the metacarpal bone.

Sixteen roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Lesions of the Suprapatellar Plica. Garrett Pipkin. J. Bone & Joint Surg. **32-A:** 363–369, April 1950.

The suprapatellar plica is the fold of synovia extending from the suprapatellar pad to the intercondylar notch, representing fusion of the suprapatellar bursa with the knee joint. It is present in 78 per cent of adult knees. The recognition of this plica is quite important since it may be considered an adhesion and lead to operation.

The author has made a study of the suprapatellar plica in postmortem specimens and reviewed 247 pneumoarthrograms in an attempt to determine the normal plica shadow. He found 4 variations: (1) an open communication, with no evidence of a plica remaining between the suprapatellar bursa and the knee joint; (2) a moderate plica; (3) a distinct separating membrane, but with no communication; and (4) no communication. In the last instance the suprapatellar space appears abnormally small, because the portion ordinarily contributed to it by the bursa is not visualized.

In cases of open communication between the bursa and the joint, fibrosis, hyalinization and calcification of the plica may be seen. Such changes may produce recurrent disability of the knee and must be differentiated from other intra-articular disabilities.

Seventeen illustrations, including 12 roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Occurrence of Calcaneonavicular Synosteosis in Pes Valgus Contractus. H. Herschel and J. R. von Ronnen. J. Bone & Joint Surg. **32-A:** 280–282, April 1950.

It is well known that calcaneonavicular synosteosis occurs in association with pes valgus contractus. In the authors' experience, this combination would seem to be more common than is generally assumed. In a three-month period, they found 4 instances of synosteosis in 5 cases of spastic flat-foot.

This deformity might possibly be overlooked in a conventional examination of the foot, but if a lateral 45-degree angle view is added, the synosteosis between the navicular and calcaneus can be demonstrated. The deformity may consist in (1) a complete bony bridge between the calcaneus and navicular; (2) a syndesmosis, in which osseous bodies are imbedded in the fibrous tissue; (3) an amphi-arthrosis, in which there is a stiff joint between abnormal protuberances of both bones.

It is believed that calcaneonavicular synosteosis will be found more frequently in a spastic flat-foot if the condition is looked for and proper radiographs are made.

Nine roentgenograms. JOHN B. MCANENY, M.D.
Johnstown, Penna.

GYNECOLOGY AND OBSTETRICS

Principles of Uterine Growth in Pregnancy. Edward Clark Gillespie. Am. J. Obst. & Gynec. **59:** 949–959, May 1950.

Observations on litter-bearing animals and certain primates have furnished evidence that uterine enlargement in pregnancy is a continuous process consisting of several separate phases each with different physiology. Thus there is a period of preparation, a period of proliferation, and a period of elongation.

The study recorded here concerns the growth of the human uterus in pregnancy. It consisted of a radiological investigation of uterine enlargement as suggested by lateral and anteroposterior soft-tissue x-ray examination of the abdomen at regular intervals until term. Incidentally, the average number of exposures

was ten, and each patient studied delivered a normal viable child at term. Measurements of uterine and fetal growth in pregnancy were made from uteri removed at various stages of gestation for whatever reason.

Results of this study reveal that at the twentieth week, the uterus is definitely spherical in shape and that from this point on it begins to elongate rapidly, its outline becoming cylindroid as demonstrated by x-ray examination.

The human uterus grows rapidly during the first twenty weeks of pregnancy. This growth probably includes both the myometrium and its vessels. The fetus grows rapidly in the last half of pregnancy and uterine enlargement thereafter consists of elongation and myometrial stretching and vascular uncoiling. The duration of pregnancy is conditioned by the myometrial stretch limits. Abnormal diminished myometrial growth during the first twenty weeks could produce premature labor. Abnormal diminished vascular growth during the first twenty weeks could produce premature uterine ischemia in the last trimester, a plausible basis of late pregnancy toxemia.

One roentgenogram; 8 drawings; 3 charts.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Hydramnios. C. H. G. Macafee. J. Obst. & Gynaec. Brit. Emp. **57:** 171–182, April 1950.

In a series of 10,902 patients at the Royal Maternity Hospital, Belfast, the incidence of hydramnios was 1.2 per cent (131 cases) and in a series of 1,119 private patients referred to the author in the early weeks of pregnancy the incidence was 1.4 per cent (16 cases), the criterion for the diagnosis being the presence of excess liquor amnii to a degree which indicates the advisability of x-ray examination.

Acute hydramnios is relatively rare, occurring only twice in the 147 cases, both times in association with uniovular twins.

There should be little trouble in determining the presence of hydramnios when a single fetus is present, but difficulty does arise in multiple pregnancies and the true diagnosis may not be possible until the x-ray examination has been made. The incidence of multiple pregnancy and chronic hydramnios in the present series was 13.8 per cent. Hydramnios may be confused with hydrops foetalis, where the gross uterine enlargement is due chiefly to the abnormal size of the placenta. In such cases the uterine wall feels abnormally thick, rather than thin, and the fetal parts are obscured by the large placenta.

Cases examined roentgenographically are divided into four groups: (1) those in which x-ray examination showed a gross abnormality either in a single fetus or in one fetus of a multiple pregnancy (54 cases); (2) those with no roentgen evidence of fetal abnormality (78 cases); (3) those in which the hydramnios was associated with diabetes (6 cases); (4) those in which the hydramnios was associated with intrauterine death (9 cases). The fetal mortality was high in Group I (94.6 per cent). If it were not for the fact that the fetal abnormality (anencephaly in both instances) was associated in one case with twins and in another with triplets, no babies would have survived in this group. Forty-seven fetuses were anencephalic. In Group II, even in the presence of radiologic evidence of a normal fetus, 33 per cent of the infants were born dead and presented unexpected malformations. In the diabetes group there were 3 live births.

The treatment of the hydramnios and the management of labor are discussed. The value of paracentesis is questioned.

Twelve tables.

Fallibility of Radiological Diagnosis of Erythroblastosis Foetalis. J. C. McClure Browne. J. Obst. & Gynaec. Brit. Emp. **57:** 71–72, February 1950.

In erythroblastosis fetalis roentgen studies of the fetus *in utero* afford valuable data, and may permit a diagnosis in certain cases (Ritvo, Schauffer, and Krosnik. Am. J. Roentgenol. **61:** 291, 1949. Abst. in Radiology **54:** 304, 1950). [The roentgen findings which have been described are: (1) soft-tissue changes, consisting of generalized edema and enlargement of the fetal liver and spleen, producing a halo about the fetus; (2) abnormalities of the skeleton, with increased densities in the bones; (3) evidences of fetal death. The fetus may be in the Buddha position, and hydramnios may be present.]

The author reports 2 cases in which the Buddha position and the halo sign were present, and therefore the diagnosis of erythroblastosis fetalis was considered, but in each instance a normal fetus was delivered. It is suggested that these signs be valued only together with all other evidence of severe fetal damage.

Three roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Secondary Abdominal Pregnancy. Bryan L. Jeaffreson and Nestor J. S. Nathan. J. Obst. & Gynaec. Brit. Emp. **57:** 65–67, February 1950.

A case of secondary abdominal pregnancy is presented in which the uterus was felt as a discrete swelling to one side of the fetal parts. It was thought that the fetus was free in the abdominal cavity. A radiograph showed the position to be transverse, and Spalding's sign, indicating fetal death, was recognized. A hysterogram showed the uterus to be enlarged and displaced by the extra-uterine fetus.

Two roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Endometriosis Ovarii et Peritonaei Caused by Hysterosalpingography (Contribution to the Pathogenesis of Endometriosis). Gunnar Teilum and Valdemar Madsen. J. Obst. & Gynaec. Brit. Emp. **57:** 10–16, February 1950.

The authors report several cases of endometriosis found at laparotomy at variable intervals after hysterosalpingography was done. No pathological controls were possible, and it cannot be stated with certainty that there was a direct causal relationship. However, the endometriosis was found to be localized to the surface of the ovary or tube, in relation to the remnants of the contrast medium, suggesting a metaplastic transformation of the surface epithelium into epithelium of endometrial type.

Twelve photomicrographs.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

THE GENITO-URINARY SYSTEM

The Rationale of Sodium Bicarbonate in Excretory Urography. Stephen Burdon, Robert Lich, Jr., and Joseph E. Maurer. J. Urol. **63:** 745–747, April 1950.

Recently it has been pointed out that excretory urograms of improved diagnostic quality may be obtained if in addition to the standard preparation of dehydration and catharsis, sufficient sodium bicarbonate to render the urine alkaline be administered (Trattner: Am. Urol. Assoc., Buffalo, N. Y., 1947).

In a study to determine the effect of sodium bicarbonate on total urinary output, the authors administered to 12 patients without evidence of renal disease sufficient sodium bicarbonate to render the urine alkaline and recorded the urinary outputs. It was found that the total output of urine for a twenty-four-hour period was reduced by as much as 100 to 1,075 c.c. as compared with control periods of the same duration. The authors believe that this reduction in total urinary output, rather than alteration in solubility of the iodine compound, is the factor which accounts for improved excretory urograms when this method of preparation is used.

One graph. HENRY C. BLOUNT, JR., M.D.
University of Pennsylvania

Neuroblastomas Involving the Urinary Tract. Francis G. Harrison, Herbert L. Warres, and John A. Fust. J. Urol. **63:** 598–612, April 1950.

The authors present 8 cases of neuroblastoma involving the urinary tract in patients ranging in age from four months to fifty-four years.

Although most neuroblastomas arise in the abdomen, they may arise anywhere along the sympathetic chain. In the present series the probable sites of origin were: the right adrenal in 2 cases, the left adrenal in 1 case, the left kidney region in 2 cases, region of the left renal artery in 1 case, the lower abdominal sympathetic chain in 2 cases. Neuroblastoma is usually seen in infants and children but it not uncommonly occurs in adults. Metastasis may be widespread. The bones and the liver are frequently involved.

Since 60 per cent of neuroblastomas arise in close proximity to the genito-urinary tract, the urologist is frequently called upon to make the diagnosis. A misdiagnosis of Wilms' tumor is frequently made.

While there are no characteristic x-ray findings, certain features point toward the diagnosis of neuroblastoma. The tumors frequently show evidence of calcification. This is usually of the fine, flaky type, though extensive calcification has been reported. When the growth is in the region of the kidney but not involving it, the kidney may show evidence of displacement. When the kidney is directly involved, a spider-like distortion of the renal pelvis and calyces often occurs. Ureters may show displacement, with evidence of stricture and hydronephrosis. A neuroblastoma of the pelvis often produces a filling defect of the bladder. Excretory urography may disclose a non-functioning kidney.

The authors believe that uniformly poor prognosis is not warranted, since survivals of three to eight years after diagnosis are reported. They consider early surgery followed by irradiation the treatment of choice.

Five roentgenograms; 4 photographs; 6 photomicrographs. JACK EDEIKEN, M.D.
University of Pennsylvania

Replacement Lipomatosis and Its Simulation of Renal Tumors. A Report of Two Cases. Wayne A. Simril and D. K. Rose. J. Urol. **63:** 588–592, April 1950.

In some instances in which renal parenchymal tissue is destroyed by disease it is replaced by masses of fat. This fat is not encapsulated and has not been known to undergo malignant change. Nephrosclerosis, arteriosclerosis, amyloidosis, chronic glomerulonephritis, hypernephroma, calculi, pyelonephritis, and tuberculosis have been listed as preceding the lipomatous replacement.

The presumptive diagnostic signs of replacement lipomatosis are reviewed. It may be suspected in the presence of chronic renal infection, calculi, poor function of the affected kidney, and a filling defect in the pyelogram (Roth and Davidson: J. A. M. A. **111:** 233, 1938).

The authors report two cases. The first patient, a 66-year-old man, gave a history suggesting left kidney disease. Survey films of the urinary tract and intravenous and retrograde pyelography revealed an opaque stone in the left renal collecting system and also a filling defect with compression and displacement of the middle and inferior calyces. Nephrectomy was performed. Pathological study showed a large pad of fat in the kidney hilus. Acute and chronic pyelonephritis, hydronephrosis, and lithiasis were also present.

The second patient, a woman 53 years old, gave a typical history of chronic lithiasis and pyelonephritis, with a similar radiographic picture. After nephrectomy, the renal parenchyma was found to be replaced by fatty tissue.

Three roentgenograms; 2 photographs.
FRANCISCO CAMPOY, M.D.
University of Pennsylvania

Congenital Hydrocalycosis: Hydrocalycosis of a Single Renal Calyx in a Newborn Infant with Complete Destruction of the Kidney. Henry M. Weyrauch and Albert E. Fleming. J. Urol. **63:** 582–587, April 1950.

The authors present an unusual case of congenital hydrocalycosis of a single renal calyx causing complete destruction of the kidney. A mass was noticed in the right side of the abdomen shortly after birth. A roentgenogram showed this to be of soft-tissue density, merging with the outline of the liver above and extending below into the bony pelvis. Intravenous urography was attempted but the medium did not concentrate in the right kidney. Subsequently a ureteral catheter was introduced into the right renal pelvis, skiodan was injected, and a pyelogram was obtained showing that the medium had laked to form a crescentic shadow in what appeared to be the lower pole of a huge hydronephrotic kidney. The child was operated upon at sixteen days of age and made an uneventful recovery. The histology is described in detail. Search of the literature failed to reveal any previous report of such a pathologic condition.

Ten illustrations, including 2 roentgenograms, photomicrographs, diagrams, and pictures of the operative specimen. JOHN F. GIBBONS, M.D.
University of Pennsylvania

Ureterocele Simulating Bladder Calculus. A. J. S. Burger. South African M. J. **24:** 298–300, April 22, 1950.

Ureteroceles vary greatly in size and in symptoma-

tology. Larger ones interfere with micturition mechanically by blocking the internal meatus. Other symptoms are usually related to complicating infection or stones—frequency, urgency, pain, hematuria, and incontinence. Urography and cystoscopy are the principal methods of diagnosis. Urography may not be conclusive. The small ureterocele that collapses during the periodic contraction of the ureter may be missed. The ureterocele may be continuous with a dilated ureter above, or it may be completely cut off from the vesical margin and thus not seen. It may appear as a filling defect in the bladder, the clarity of this depending upon the power of concentration of the kidneys. The same picture will be produced by the retrograde cystogram. Where the kidneys show good function, the ureterocele presents as a bulbous lower end of the ureter with a translucent halo surrounding it. On the other hand, when the cyst is of large size, almost filling the bladder, it may be merely an opaque halo surrounding the ballooned sac. Treatment consists of wide incision through the cystoscope.

A case is reported of a moderate sized ureterocele which contained a stone. It was beautifully demonstrated by intravenous pyelography on the fifteen-minute film.

Two roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Cysto-Urethrography: Its Role in Diagnosis of Neurogenic Bladder. Charles Ney and John Duff. J. Urol. **63:** 640–652, April 1950.

Eleven radiologic appearances of the lower urinary tract which may be observed in cases of neurogenic bladder are described and illustrated; they are not in themselves diagnostic, but the occurrence of one or more in a cysto-urethrogram should suggest neurologic disease or injury.

(*A*) *Funnel urethra* represents a dilatation of the prostatic urethra, with the widest portion at the bladder neck, gradually tapering distally and usually ending proximal to the external sphincter. It may be present in normal individuals.

(*B*) *Pine-tree shaped bladders* are those which taper inward at the dome. Patent urachus must be differentiated as a cause of this anomaly.

(*C*) *Vesico-ureteral reflux* may occur with a neurogenic bladder; it is also seen in vesical neck obstructions and tuberculous and non-tuberculous cystitis.

(*D*) *Hour-glass bladder* may be caused by relaxation of the trigone due to cord bladder, by congenital diverticula, septa, or patent urachus, and by inflammatory or traumatic scarring.

(*E*) *Saccular dilatation of the posterior urethra* is similar to funnel urethra except that the widest portion is in the mid-prostatic urethra rather than at the bladder neck.

(*F*) *Pseudo-sphincter formation* is a term used to describe a urethral constriction between the internal and external sphincters; its significance is uncertain.

(*G*) *Spastic external sphincter.*

(*H*) *Relaxed external sphincter.*

(*I*) *Contracted hypertonic bladder.*

(*J*) *Large hypotonic bladder.*

(*K*) *Bladder calculus formation* is a frequent accompaniment of the cord bladder and is probably due chiefly to the long continued recumbency in these cases, plus other incompletely assessed factors.

The authors have reviewed the literature and find little agreement as to the significance or cause of the described appearances in the cord bladder. Their bibliography includes one hundred and sixty-one references.

Eleven roentgenograms.

WILLIAM C. OWSLEY, JR., M.D.
University of Pennsylvania

Vesical Calculi in Young Female Children. John I. Waller and Frank Adney. Am. J. Dis. Child. **79:** 684–691, April 1950.

An unusual case of a stone in the bladder of a five-year-old girl, secondary to a foreign body, is presented. In a review of the literature, the authors found that vesical calculi occur much more frequently in boys than in girls, and also that they are relatively rare in younger children.

The patient was admitted to the hospital with urinary symptoms. Roentgenograms showed a bobby pin with a large calculus surrounding it in the region of the bladder. Cystoscopy confirmed the radiologic observation, a suprapubic cystostomy was done, and the calculus was removed, the patient making an uneventful recovery.

Four roentgenograms; 2 tables.

NELSON KLAMM, M.D.
Cleveland City Hospital

Use of Radio-Active Phosphorus (P^{32}) in the Diagnosis of Testicular Tumors: A Preliminary Report. Bernard Roswit, J. Sorrentino, and Rosalyn Yalow. J. Urol. **63:** 724–728, April 1950.

The authors state that, in general, tissues showing a high metabolic activity, either in form of rapidly reproducing cells or because of active inflammation, have a high uptake of radioactive phosphorus.

Patients suspected of having testicular tumors were given tracer doses of 300 to 500 microcuries of radioactive phosphorus orally and counts were made with Geiger counter tubes over the testicles, at two, four, and twenty-four hours later. The counts obtained over the normal testicle were compared with counts over the abnormal testicle. When counts were more than 25 per cent greater on the abnormal side, the test was interpreted as suggesting a malignant lesion. In 4 of 6 tumors tested in this manner, 2 benign and 2 malignant, the test proved correct. There was one false positive and one false negative. In the false negative test the malignant tumor was surrounded by compressed normal tissue. The correct diagnosis in the false positive case proved to be benign granuloma.

One table. HENRY C. BLOUNT, JR., M.D.
University of Pennsylvania

THE BLOOD VESSELS

Arteriosclerosis and Arterial Thrombosis in the Lower Limb. A Roentgenological Study. Åke Lindbom. Acta radiol., Suppl. LXXX, 1950.

This 80-page monograph is a carefully compiled and statistically noteworthy report on arteriography of the lower extremity. The description of various arterial changes accompanied by radiographic evidence of their presence is important to anyone embarking on arterial studies for vascular disease.

The examination by arteriography of autopsy material (356 limbs) and living patients (295 limbs) is reported, with the findings on dissection and histologic

examination of the postmortem cases. The careful analysis of this material gives the paper a broad scope. The description of the technic of arteriography both on living patients and autopsy material is sufficient to allow duplication by anyone reading the original paper.

The findings in arteriosclerosis in the main vessels of the lower limb are as follows:

(1) Intimal thickening shows a characteristic distribution in the femoral and popliteal arteries. Slight lesions are more common just above the knee joint and the distribution is parallel to the localization of the origins of the main branches. Pronounced intimal thickening has a different distribution, indicating that an additional factor is present in its production.

(2) Constriction of the branches of the main arteries at their origin is a prominent feature in arteriosclerosis.

(3) Intimal calcification differs radiologically from medial calcification, and calcification at the internal elastica can also be differentiated. Intimal calcification is a sign of arteriosclerosis with considerable encroachment upon the lumen, while medial calcification is rarely associated with intimal thickening. Localization of the latter is dependent upon movements of the artery. Calcification at the internal elastica is nearly always most apparent in the anterior tibial artery at the ankle joint. Examination of the peripheral arteries for the presence of calcification is made by taking a plain roentgenogram of the thigh in the region of Hunter's canal.

Arterial thrombosis in the lower limb is more common than coronary thrombosis in elderly patients. Hunter's canal is the origin of most thrombi in the femoral artery, and they nearly always grow in a proximal direction. Thrombosis of the profunda femoris is exceedingly rare.

The significance of intimal hemorrhage is discussed. Since this lesion has a predilection for the same site as arterial thrombosis, it is suspected as a direct cause. Intimal hemorrhage is thought to be the result of tearing of the sclerotic artery at the sites where the latter is dislocated during movements in muscles and joints.

Forty-two figures, including numerous roentgenograms.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Changes in the Rate of Flow of Venous Blood in the Leg During Pregnancy, Measured with Radioactive Sodium. H. Payling Wright, S. B. Osborn, and D. G. Edmonds. Surg., Gynec. & Obst. **90:** 481-485, April 1950.

In a previous paper (J. Obst. & Gynaec. Brit. Emp. **56:** 36, 1949. Abst. in Radiology **54:** 138, 1950) the authors showed that the average venous blood flow rate was markedly decreased during labor, and that the normal rate was regained four to ten days later. It was thought that this decrease was due to the increased pressure on the large veins as they traversed the pelvis. By measuring the flow with radioactive sodium, the authors have now studied a group of pregnant women from early in pregnancy to the puerperium. They found that the increase in foot-groin time was gradual and constant during pregnancy and that the engagement of the head probably caused a secondary obstruction to flow. It was also shown that the decreased venous flow in the legs is not a generalized response, since the hand-axilla time remained essentially unchanged.

The significance of this decreased venous flow is obvious, in that it may be a factor in the onset of venous thrombosis in pregnancy.

One case is briefly presented.

Four graphs; 2 tables.

JACK EDEIKEN, M.D.
University of Pennsylvania

Aneurysm of the Splenic Artery. Report of Two Cases. Benjamin Sherwin and Harry Gordimer. Ann. Surg. **131:** 599–603, April 1950.

Two cases of aneurysm of the splenic artery are presented. In one the diagnosis was made preoperatively, operation was performed, and the patient recovered. In the other the diagnosis was not made before rupture, which proved fatal.

Aneurysm of the splenic artery is a rare entity, approximately 144 cases having been reported. Its importance lies in the fact that the mortality rate is extremely high after rupture, so that any clue that may lead to its early diagnosis is of importance. X-ray examination is extremely important if there is sufficient calcium present in the wall of the aneurysm and was the means of establishing the diagnosis in the authors' first case. The aneurysm is usually depicted as an oval shadow in the left upper quadrant of the abdomen, with the periphery sharply delineated and the central portion presenting a mottled appearance.

Three illustrations, including 1 roentgenogram.

GLENN F. MILLER, M.D.
The Henry Ford Hospital

Fatality after Abdominal Arteriography. Prevention by a New Modification of Technique. Frederick B. Wagner, Jr., and Alison H. Price. Surgery **27:** 621–626, April 1950.

The authors report the first known fatality after abdominal arteriography performed by direct translumbar injection. In a 41-year-old patient with hypertensive cardiovascular disease and arteriosclerosis, the needle accidentally entered the superior mesenteric artery, which thus received the 80 per cent sodium iodide solution intended for the abdominal aorta. The patient complained of constant diffuse abdominal pain and died seven hours later. Though no autopsy was performed, death was attributed to mesenteric thrombosis.

Though the authors had previously accidentally injected vessels other than the aorta without untoward effect, they recommend as a safety measure that abdominal aortography with a full dose of 80 per cent sodium iodide solution be performed only after the exact position of the needle has been determined by preliminary injection of 10 c.c. of 30 per cent sodium iodide.

Four roentgenograms.

CHARLES SILVERSTEIN, M.D.
Emory University School of Medicine

Experimental Studies of the Histologic Lesions of the Arterial Walls Caused by Iodine Contrast Media Used in Arteriographs. L. Campi and and S. Abeatici. Radiol. med. (Milan) **36:** 312–318, April 1950. (In Italian)

The authors have injected in arteries of dogs various amounts of a 70 per cent solution of diodrast. The arteries of the dogs were removed and examined histologically and no abnormalities were discovered. Injections were also made of a 110 per cent solution or tenebryl. After high and repeated doses the arteries of the dogs showed lesions consisting essentially of prolifer-

ations and scarring of the intima and in one case it was possible to demonstrate formation of a small thrombus.

Six photomicrographs.

CESARE GIANTURCO, M.D.
Urbana, Ill.

TECHNIC

Spot Orthoroentgenography. A Method for Measuring the Length of the Bones of the Lower Extremity. Louis A. Goldstein and Frank Dreisinger. J. Bone & Joint Surg. **32-A:** 449–452, April 1950.

This article describes a method of measuring the length of the bones of the lower extremity. The patient lies supine on a long cassette, measuring 14 × 36 inches, and, with a long brass cylinder attached to a cone base with four brackets of the right-angle type, spot roentgenograms of the various joints are made while the extremities are held immobile and in fixed position. A view of one hand is also spotted on the film to determine bone age.

The brass cylinder, measuring 26 inches in length and 4 1/2 inches in diameter, is marked at the four quadrants to help in centering accurately over the various joints. Each joint is exposed separately and individually and a target-film distance of 40 inches is used. This long target distance, the long cone, and the perfect centering over the various joints are the salient features of this procedure. Exposure factors, sources of error, and advantages of the method are discussed.

Three illustrations. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Technical Apparatus for Angiocardiography, Indications and Contraindications. S. Buchs and G. Frommherz. Schweiz. med. Wchnschr. **80:** 347–349, April 8, 1950. (In German)

The authors illustrate and briefly describe a serialographic device for angiocardiography similar in principle and design to a large roll-film camera. It operates with intensifying screens and can expose a film every 0.6 second if necessary.

Three illustrations. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Determination of Physical Factors Influencing the Quality of the Radiographic Image (The Reproduction Number Method and Its Application). Arne Nelson. Acta radiol., Suppl. LXXVI, 1949.

The author has attempted to reach a general and practically serviceable method for determining the effect of the different physical factors on the radiographic image. The monograph contains a survey of previous work in this field, as reported in the literature, particularly on photometric and intensitometric methods.

The new method described here is called the reproduction number method. A special test plate of plexiglass containing a combination of steps of various thicknesses and holes of various sizes is radiographed. The number of holes which can be recognized on the completed film is called the reproduction number. It was attempted to determine this number by photometric methods, but these were discarded as being impractical because of lower sensitivity and excessive time consumption.

The method was used in a study both of radiography and photofluorography. The author reached the following conclusions:

1. The method can be made use of to form an estimation of image quality.
2. The reproduction number decreases with increasing kilovoltage and thickness of the object.
3. The aluminum cassette gives an image of better quality than the ebonite cassette, and this method can also be used to determine the intensifying qualities of screens.
4. The sensitivity and gradation of different films can be compared as well as the suitability of different developers and optimal time and temperature conditions.
5. Schmidt optics and lens optics can be compared, and a comparison can be made between photofluorographic film sizes. The tests have also shown the great advantage in using a secondary diaphragm in fluorography.

The practical applications can be summarized as (*a*) determining the effect of a specific physical factor which influences the image quality; (*b*) detecting the reasons for changes in the quality of the image; (*c*) continuous control of the standard of the quality of the image.

Twenty-four figures; 11 tables.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Duplication of Roentgenograms by Artificial Solarization, with Emphasis on a Simple Standardized Technique. William H. Roper. Am. Rev. Tuberc. **61:** 725–729, May 1950.

A standardized technic for duplication of roentgenograms by artificial solarization is presented. The method is felt to result in an excellent quality of reproductions by means of contact printing. A negative is obtained from a negative roentgenogram and this saves the dual step of transferring to an intermediary positive and then to a negative.

One chart. JOHN H. JUHL, M.D.
University of Wisconsin

MISCELLANEOUS

Calcinosis Interstitialis Circumscripta. Review and Case Report. Mitchell S. Madison. West Virginia M. J. **46:** 88–93, April 1950.

Calcinosis interstitialis circumscripta is a form of calcification occurring in the skin and subcutaneous tissue, of chronic nature and relatively unnoticeable at its onset. It is seen most commonly in adult women, and deposits are limited to the skin and subcutaneous and interstitial tissues of the upper extremities, particularly the fingers.

The etiology is undetermined and histologic reports are conflicting. The first symptoms may be soreness and tenderness in a local area of skin. Multiple discrete subcutaneous nodules become palpable and the overlying skin is red and inflamed, ultimately breaking down, with the formation of small shallow ulcers, from which a chalky material is discharged. The lesions are most likely to occur at points of frequent trauma. The diagnosis is based on the clinical picture, the demonstration of radiopaque nodules, and pathological and chemical studies. To be differentiated are calcified lipoma, phleboliths, calcified tuberculous nodes, vari-

ous types of metastatic calcification, myositis ossificans, and gout.

The author reports a typical case with associated Raynaud's disease. The patient was seen by numerous observers over a period of twelve years, during which various diagnoses were made. Roentgenograms taken in 1935 showed concretions in the distal phalanx of the right middle finger. These were removed, but films in 1944 and 1946 showed new calcium deposits.

Three roentgenograms.

J. E. WHITELEATHER, M.D.
J. E. GARDNER, M.D.
Memphis, Tenn.

Roentgenology of Parasitic Calcification. Eric Samuel. Am. J. Roentgenol. **63:** 512–522, April 1950.

The author briefly reviews the various radiographic manifestations of parasitic calcification and suggests the following classification: (*a*) calcification of the adult worm, most commonly seen in the Guinea worm of India, Africa, Persia, and Brazil; (*b*) calcification in the cystic stage, as in cysticercosis, trichinosis, and hydatid cyst; (*c*) calcification in flukes; (*d*) calcification in larvae, of which Bilharzia is an example; (*e*) protozoan parasites, such as Toxoplasma; (*f*) calcification in nymphs.

The calcified Guinea worm may be seen subcutaneously in an extremity or in the scrotum, either as a coiled mass or single tortuous streak.

In cysticercosis the intramuscular cysts in the early stages of calcification may appear as small oval "rain drops"; later the scolex may be identified within the cyst. The intracranial cysts tend to be round and calcification appears as faint areas or patches. Trichinella cysts probably are not demonstrable roentgenographically. In hydatid disease, calcification occurs in both the true cyst wall and the reactive tissues of the host.

Liver flukes, endemic in Western China, are seldom if ever seen in the white race.

In Bilharzia infestation, calcification may occur in the wall of the urinary bladder and in the lower ureters.

Toxoplasma and nymph calcifications are only briefly mentioned. The nymph stage of *Armillifer armillatus* may form extensive calcification in the celomic cavities. The calcified nymph has a characteristic comma-like appearance.

Twenty-three illustrations, including 20 roentgenograms.

I. MESCHAN, M.D.
University of Arkansas

RADIOTHERAPY

Cancer of the Center Face. J. B. Howell. South. M.J. **43:** 283–290, April 1950.

The center face is a common location for cutaneous cancer, yet the therapeutic approach is more difficult and initial treatment fails more frequently than in other locations. The use of low-intensity radium needles interstitially for cancer of this region is a technic highly recommended by the author. In early lesions of the septum, floor of the nose, or outer nasal wall, this method is simple, safe, gives good results, and is followed by little post-radiation inconvenience.

The advantages of this approach are chiefly that a lesion involving, for example, the entire nose may be needled properly without development of painful chondritis or cartilage necrosis, the cosmetic results are good, dosage calculations are possible, coverage is better, accuracy of approximation of the radiation source to the tumor is greater, and the cure rate is high.

Technically, the procedure is briefly as follows: A barbiturate is given half an hour prior to local anesthesia. The extent of the lesion should be accurately estimated, and if the size warrants, careful isodose measurements consulted. Small stab incisions are made in the skin and the needles are inserted in a single layer, approximately 1 cm. apart, in a previously arranged pattern to insure uniform dosage.

The needles are left in place for 168 hours, giving a dose of approximately 6,000 to 12,000 gamma roentgens. The active length of the needles is 0.5, 1.5, and 4.0 cm. and they contain, respectively, 0.66, 1.33, and 2.4 mg. of radium. They are constructed of platinum with a wall thickness of 0.5 to 0.6 mm. Hospitalization is usually not necessary, but the needles should be checked at least every other day.

Cancer of the center face is predominantly basal-cell in type, about 10 to 20 per cent of the lesions containing prickle-cell elements.

In epithelioma about the eye there is a definite predilection for involvement of the medial portion of the lower lid and the region about the inner canthus. Tumors involving the canthus are particularly difficult to handle due to their strategic location and their habit of early infiltration of inaccessible sites. The author treats all cancer of the lids and canthi, except very superficial lesions measuring approximately 1 cm. or less, with interstitial radium. The small superficial lesions he treats with low-voltage x-rays; however, he considers x-ray inferior to interstitial radium for infiltrative lesions of the canthi and lids. Sequelae of radiation treatment about the eye are chiefly at the expense of conjunctiva and skin, the eye itself, with the exception of the lens, being somewhat radioresistant.

Late effects on the conjunctiva may be scarring, thickening, adhesions to sclera, ectropion, and epiphora. Cataract may occur, but the chances of this are minimal. In a large infiltrating lesion which endangers the eye and even life, the possibility of occurrence of cataract is outweighed by the gravity of the disease.

Five photographs; 4 treatment diagrams; 1 chart.

HARVEY J. THOMPSON, JR., M.D.
Jefferson Medical College

Results of Treatment of Carcinoma of the Lip. Grant E. Ward and James W. Hendrick. Surgery **27:** 321–342, March 1950.

This report is based on a study of 259 consecutive cases of proved epithelioma of the lip at Johns Hopkins Hospital over the fifteen year period 1930 to 1945; 251 of these patients were men, and 50 per cent were past sixty years of age. The tumor was on the lower lip in 239 cases.

Cancer of the lip is more common in individuals with thin dry skin, little pigmented, and particularly in those exposed to the elements, notably sunlight. In 38 per cent of this series there had been a precancerous keratosis, leukoplakia, or chronic fissure of the lip; 86 per cent of the tumors were of low-grade activity (Grade I or II, Broders).

The authors are convinced that irradiation, electrocoagulation, or any other therapeutic agent which fails to destroy the lesion completely will render it more malignant and more active, with a greater likelihood of metastasis.

A complete description of the anatomy of the lymphatics of the lips is given, stressing the facts that there is free anastomosis across the midline and that collective trunks frequently (22 per cent) enter the mental foramen, causing involvement of the mandible.

The authors agree that certain lip cancers may be eradicated by either surgery or irradiation, but definitely prefer surgery. Rather detailed surgical technics are described, varying with the size of the lesion and the site of involvement. A lesion of low histologic grade under 1.5 cm. in diameter and 4 or 5 mm. deep, in an elderly patient, or one who refuses "sane operative treatment," may be treated by irradiation, with "variable results." The authors give 6,000 to 7,000 r, unfiltered, in divided doses at five or six sittings, at two to three day intervals. They seldom use radium in any form in the primary treatment of lip cancer.

If the lesion is under 3 cm. in diameter, of low histologic grade, with no palpable nodes in the submental or submaxillary regions, no suprahyoid dissection is advised. The same advice is offered for higher grade lesions that are less than 1.5 cm. in diameter. These patients should, however, be observed at frequent intervals. If nodes develop, suprahyoid dissection is done at once. If the lesion is limited to the lateral third of the lip, with enlarged, firm nodes on one side only, neck dissection should be unilateral. If the lesion is in the middle of the lip, with palpable nodes on either side, bilateral dissection is done. In the event that positive nodes are found in the suprahyoid resected specimens from either or both sides of the neck, radical neck dissection is done on either or both sides. Extensive metastases on one side of the neck, with the nodes fixed to surrounding structures or mandible, are first heavily irradiated, followed by radon seed implantation, to reduce the size of the mass. After five or six weeks, a radical neck dissection is done *en bloc*, together with section of the mandible, floor of the mouth, and other soft parts, as indicated. The defect may later require plastic surgery.

The following conclusions are reached: (1) The larger the original lesion, the less chance of its curability. (2) Patients who have had previous treatment are more prone to node metastasis. (3) There is a definite relationship between the histologic grade of the tumor and recurrence, and between recurrence and curability. (4) All cases considered, surgery gives 10 to 12 per cent more five-year non-recurrences than irradiation.

Nineteen illustrations, including 1 roentgenogram; 6 tables.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Treatment of Cancer of the Tongue. A. Jentzer. Schweiz. med. Wchnschr. **80:** 429–432, April 29, 1950. (In French)

All intervention in the buccal cavity should be preceded by minute disinfection and the removal of carious teeth. Results of therapy vary according to the location of the tumor. The least favorable prognosis is seen in tumors of the base of the tongue, since surgery is difficult and lymphatic spread is frequent. In anterior tumors the author attempts to remove the tumor and then implants radon seeds of 1 mc. strength, 1 cm. apart. The filter of the seeds is 0.3 mm. gold, allowing beta irradiation about 3 mm. around the needle. A dose of 3,000 gamma r at 1 cm. depth is desired. This is followed by radium moulage with 1 mm. of platinum as filter, giving 4,800 gamma roentgens to the skin in three days.

Seven case histories are included.

Eleven illustrations.

CHARLES NICE, M.D.
University of Minnesota

Carcinoma of the Ear. Charles E. Towson and William H. Shofstall. Arch. Otolaryng. **51:** 724–738, May 1950.

The incidence of carcinoma of the ear has been variously stated. The authors found 7 cases among 1,883 patients seen in 1947 and 1948 in the Department of Otology of the Jefferson Hospital, Philadelphia. The symptoms and signs are usually persistent intractable pain radiating along the course of the trigeminal nerve, bloody discharge, ulceration of the external auditory canal, aural growths or polyps, palsy of various cranial nerves (most commonly of the facial), deafness, vertigo, mastoid tenderness, and tinnitus.

Surgery has been an effective method of treatment if the lesion is seen early, but it must be radical enough to remove all the tumor, which at times means a mutilating and disfiguring procedure. Irradiation is effective in some cases, but the authors quote Pfahler and Vastine as stating that a greater percentage of failures occur in treatment of patients with cancers in the region of the ear than in any other relatively superficial portion of the body (Am. J. Roentgenol. **37:** 350, 1937).

The authors' 7 cases are presented in detail. Six were squamous-cell carcinomas and 1 a basosquamous-cell carcinoma. A brief summary of 65 cases from all departments of Jefferson Hospital from 1930 through 1948 is also given. Of these, 44 were squamous-cell carcinoma; 1 basal-cell carcinoma; 4 basosquamous-cell; and in 1 the cell type was undetermined.

Eight figures, including 4 roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Single Exposures of Superficial X Rays in Cancer of the Skin. L. Janet Mallender. J. Faculty Radiologists **1:** 267–272, April 1950.

The author defends the single treatment method for skin carcinomata by citing the results obtained in treating 177 cases of either basal or squamous-cell carcinoma. Doses varied from 2,000 to over 2,500 r, depending upon the size of the lesion and the age of the patient. The apparatus used was a Victor K. X. 10 plant, operated at 80 kv.p. and 7 ma., with an added filter of 1 mm. Al, giving a half-value layer of 2.0 mm. Al. The focal skin distance was nominally 15.5 cm. but this was adjusted in the case of each applicator to produce a dose rate of 150 r per minute with backscatter for all the field sizes employed. Frank necrosis developed in 1.1 per cent, and incipient necrosis, which healed spontaneously, was seen in 3.4 per cent of this group of cases. Ninety per cent of these cases were found to be cured by the first treatment at four-year follow-up.

The results of this experiment suggest that, when applied to suitable lesions, a single application of superficial x-ray therapy is an adequate and safe method of treatment, particularly when it is borne in mind that

retreatment of the few failures brought the four-year cure rate to 98 per cent.

Six charts.

DONALD R. BRYANT, M.D.
The Henry Ford Hospital

Carcinoma of the Thyroid Gland. Grant E. Ward, J. W. Hendrick, and Robert G. Chambers. Ann. Surg. **131:** 473–493, April 1950.

A series of 112 carcinomas of the thyroid gland from the Johns Hopkins Hospital are presented. The disease may occur at any age. Three of the patients were under ten years of age and 22 less than thirty; the range was from four to eighty years. The ratio of females to males was about 2 to 1, as contrasted with the 6 to 1 ratio of goiter. There were 82 white and 30 Negro patients. It is generally considered that over 80 per cent of thyroid cancers are preceded by adenomas; the figure for this series was 77 per cent. Twenty-six per cent of the patients had symptoms of hyperthyroidism; 21 per cent also had an elevated basal metabolism rate.

The authors have used the classification suggested by Shields Warren (Am. J. Roentgenol. **46:** 447, 1941) and accepted by the American Goiter Association. Sixty-one of their series were of Group I (malignant adenomas); 37 of Group II (moderate malignancy); 14 of Group III (high malignancy). The symptoms, clinical course, and metastatic tendencies of these tumors are discussed.

Surgical eradication of thyroid adenoma is mandatory. The operability of frank cancer of the thyroid depends upon the presence or absence of distant metastases and the extent of the primary lesion. Irradiation has proved to be a definite adjunct to surgery in operable thyroid cancer when the lesion has extended to the contiguous structures. It is usually begun within ten days or two weeks after surgery, with cross-firing through three portals, each of which receives 200 r in air per sitting for a total of 2,000 r. Treatment factors are 200 kv., 50 cm. skin-target distance, filtration 0.5 mm. Cu and 1 mm. Al. The same type of irradiation has been used in inoperable cases and for local recurrence, and has proved of definite value in reducing the size of the parent lesion and holding regional metastases in abeyance. Local recurrences limited to the regional nodes are treated by surgery and irradiation. The use of radioactive iodine in thyroid cancer is touched upon.

Twenty-five illustrations, drawings, and charts.

GLENN F. MILLER, M.D.
The Henry Ford Hospital

Cancer of the Larynx Classified in Three Dimensions. An Aid in Management. Samuel Kaplan. Arch. Otolaryng. **51:** 696–698, May 1950.

A classification of cancer of the larynx is presented which considers depth as well as surface extension and origin of the growth in mucosa with and without basement membrane.

1. *Intrinsic Superficial:* The neoplasm lies within the rim of the larynx and arises from epithelium with a basement membrane. The cords are mobile. These patients are best treated by irradiation.

2. *Intrinsic Penetrating:* The neoplasm has invaded the musculature and the vocal cord is either partly or entirely fixed. The treatment of choice is surgical.

3. *Extrinsic Superficial:* The neoplasm originates in the larynx but has overgrown or spilled over the rim into adjacent tissues. The cords are mobile. These cases are best treated by irradiation unless the cervical lymph nodes are involved, in which case a radical neck dissection should be performed.

4. *Extrinsic Penetrating:* The neoplasm is similar to the extrinsic superficial type, but the cells have invaded the muscle and there is partial or complete fixation of the vocal cords. These patients should be treated surgically.

5. *Extrinsic Hypopharyngeal:* The neoplasm originates in epithelium with no basement membrane. It is found on the epiglottis, aryepiglottic folds, arytenoid cartilages, postcricoid region and piriform sinuses. Irradiation is preferable to surgery for these patients.

HOWARD L. STEINBACH, M.D.
University of California

Mixed Tumors of the Thymus. Criteria for Their Differentiation and Their Radiotherapeutic Response. Stuart J. Eisenberg and Philip F. Sahyoun. Arch. Path. **49:** 404–417, April 1950.

The thymus is composed of epithelial cells which arise from the endoderm of the third branchial cleft and lymphocytes of mensenchymal origin. The organ reaches full maturity at adolescence, after which regression begins. With this decline neoplastic changes may occur. Both cell types may participate in the formation of the tumor or one or the other may predominate. Thymic tumors are classified according to the preponderant cell type: (1) the carcinomatous group, (2) the lymphosarcomatous group, and (3) the mixed group.

The authors report 7 cases of mixed-cell tumors of the thymus. These tumors were differentiated from Hodgkin's disease on the basis of the following characteristics:

(1) *Microscopic Appearance:* The reticulo-endothelium of mixed tumors of the thymus is a syncytial mass and contains larger nuclei with coarser chromatin and prominent nuclei. The tumor giant cells are two to four times as large as the Reed-Sternberg cells of Hodgkin's disease.

(2) *Course:* The course is usually more prolonged.

(3) *Response to Radiotherapy:* Whereas in Hodgkin's disease the enlarged nodes and tumor disappear completely with roentgen therapy, the mixed-cell tumors of the thymus show arrest and improvement but not complete regression.

(4) *Dissemination:* The mixed tumors have a tendency to behave like carcinoma and infiltrate the mediastinal structures and lungs.

Seven photomicrographs.

HOWARD L. STEINBACH, M.D.
University of California

An Attempt to Evaluate the Radical and Palliative Treatment of Breast Carcinoma. Thomas G. Orr. Surg., Gynec. & Obst. **90:** 413–422, April 1950.

This article is an excellent evaluation of our present knowledge of how to treat carcinoma of the breast. Its excellence lies not in any new or startling facts, but rather in the attempt to sum up our present knowledge with all the pros and cons for the various methods. The author repeatedly stresses the fact that one should never become dogmatic in treating this form of carcinoma. What is perhaps best for one individual may not be the best for another.

The rigid criteria of operability outlined by Haagensen and Stout are summarized, but it is felt that, if these criteria are strictly followed, a small percentage of patients may be denied the possibility of a cure. The question of what constitutes a radical mastectomy is discussed and it would appear that there are almost as many types of radical mastectomies as there are men doing them. To state that a single method is the one of choice smacks of dogmatism; it is probably no more correct than some other.

Histopathological grading of breast carcinoma to estimate the prognosis has not proved of great importance. The factors of prognostic import are: the extent of the tumor, the thoroughness of its removal, and the care with which the tissue itself is studied by the pathologist. Much depends upon a careful pathological study of all the lymph nodes removed from the axilla. Saphir and Amromin (Cancer 1: 238, 1948) discovered, by making serial sections of nodes in 30 cases already routinely reported in their department of pathology, that an additional 33 per cent contained cancer.

The ever present question of preoperative and postoperative irradiation is discussed. Most groups at the present time are using postoperative irradiation in all cases in which there is a reasonable possibility that cancer has not been removed completely by the operation. This, of course, places upon the pathologist special responsibility to study all the nodes in the axilla. If, after careful study, no axillary nodes are found to contain cancer, then postoperative irradiation only subjects a patient to unnecessary trauma.

Castration, either by surgical or irradiation methods, is discussed. Undoubtedly, it may be expected to produce transient benefit in some cases. To recommend castration routinely to all women following the removal of one of their breasts seems to Orr to be poor judgment.

The present concepts of treatment with testosterone and estrogen are summarized. Enough experience has now been obtained by numerous clinics to indicate unquestionably that testosterone may prolong life, relieve pain, reduce disability, increase the appetite, produce a gain in weight, and give the patient a general feeling of hope and well-being. Most clinics reporting on the use of estrogens restrict them to patients who are at least five years beyond the menopause.

Dr. Orr finishes his excellent article by stating: "We are now in an era of radical surgery . . . . No surgery can be too radical if it will save life without misery, but we cannot, at present, look far enough into the future to dispel the doubt that extensive radical procedures will produce better results than x-ray therapy in what are now generally considered incurable cases."

Two illustrations; 3 tables.

JOHN W. HOPE, M.D.
University of Pennsylvania

Cancer of the Breast. The Scope of Irradiation. Lionel Cohen. South African M. J. **24:** 276–280, April 15, and 565–568, July 15, 1950.

After reviewing the present surgical and radiotherapeutic procedures used in cancer of the breast, the author concludes that neither surgery nor radiotherapy as practised at present solves the fundamental problem. The complete eradication of all potentially diseased tissue is not achieved, nor is it even theoretically possible to achieve this end with present-day technics. In the absence of fundamental new discoveries, however, any advance in the care of cancer of the breast must be made with either surgery or irradiation. The author cannot conceive of any modification in the radical mastectomy procedure which could meet the problem, but the scope of radiotherapy has not been finally defined and its potentialities have yet to be elucidated.

In the second half of the article the author reviews some of the important radiobiologic concepts of the treatment of cancer, pointing out that the same tumor in different locations can differ in its radiosensitivity. Thus the lymph node metastases from a mammary carcinoma are materially more sensitive to radiation than the primary growth. It is believed that the malignant cells in carcinoma of the breast can be considered in three distinct biologic categories: (1) cells *in situ* in the breast; (2) cells in transit in lymphatic vessels; (3) cells in the regional nodes. Each of these categories reacts independently to irradiation and to surgery.

The author feels that radiation cannot, with the ordinarily applied technics, eradicate cancer *in situ* in the breast, while surgery can. Cells in transit in the lymphatic vessels or cells in the regional nodes, on the other hand, he believes cannot be eradicated surgically, but can be destroyed by properly applied radiotherapy. For this reason he suggests that the appropriate therapeutic approach would be a combination of surgery and radiotherapy. He favors preoperative irradiation.

The author next investigates the problem of dosage and the rate of irradiation. From a series of 25 cases of breast cancer he has constructed a time-intensity graph which, contrary to the situation with epidermoid tumors, shows that there is no advantage in protracted treatment in mammary cancer. For this reason he has shortened the course of treatment, first to a two-week period and recently to a one-week technic. X-rays generated at 250 kv., with 1 mm. of copper filtration, are used. Five fields are treated: (1) medial tangential field; (2) lateral tangential field; (3) anterior axilla and supraclavicular; (4) posterior axilla and supraclavicular, and (5) a narrow field over the sternum. The optimal dose for a two-week course is not less than 3,500 r, each portal receiving 350 r (tissue) daily for ten treatments, over a period of twelve days. The author states that it is possible to perform the radical mastectomy on the day following the last treatment.

Two figures.

DONALD S. CHILDS, JR., M.D.
The Mayo Clinic

Studies on the Classification of Carcinoma of the Uterus. A Patho-Anatomical and Clinical Investigation. Herman Leissner. Acta radiol., Suppl. LXXVIII, 1950.

Carcinomas of the uterus are usually classified as carcinoma of the cervix and carcinoma of the corpus. A patho-anatomic study by the author revealed that there exist three types of uterine carcinoma which cannot be fitted into these two categories: (1) carcinoma low in the corpus or in the isthmus; (2) carcinoma of the whole endometrium, usually occurring in advanced cases; (3) carcinoma in double foci. Clinical classification is correspondingly difficult. Proper evaluation of therapy and other clinical considerations demand a broader classification and the author recommends the one already suggested by Heyman and the Editorial Committee of the Fifth Annual Report on the Results

of Radiotherapy, namely, cancer of (1) the corpus, (2) the cervix, and (3) the corpus and the endocervix. In the last group should be included those cases of cancer in both the corpus and the cervix uteri in which, after a clinical examination, the point of origin cannot be satisfactorily assigned to either the corpus or the cervix.

These observations are based on a study of specimens from 49 cases of cancer of the corpus uteri, reports of which are included, and a review of 38 similar cases of Cullen and Schottlaender and Kermauner.

Numerous diagrams illustrating the cases reported.

JAMES A. READ, M.D.
The Henry Ford Hospital

Status of Radiation Therapy in Carcinoma of the Cervix. Eleanor Percival and Archibald D. Campbell. Canad. M. A. J. **62:** 335–338, April 1950.

The authors report a series of 261 consecutive cases of primary cervical carcinoma treated at Montreal General Hospital between 1934 and 1943. All cases were proved histologically and classified according to the Schmitz system; 24.1 per cent were of Stage IV when first seen. Stage III cases constituted the largest group, 39.0 per cent of the total.

In all except Stage IV cases, both deep x-ray therapy and radium were used. X-ray therapy was given for palliation in Stage IV cases, with subsequent radium application in those cases showing an unexpectedly favorable response.

The radium is screened in 2 mm. brass and 3 mm. rubber, and is administered in two treatments, ten days apart, for a total dose of 4,500 to 6,000 mg. hours. Insertion is made into the uterus and the cervical canal, against the tumor and in each lateral fornix. The procedure is accomplished under general anesthesia, care being taken to protect the rectum and bladder by packing. X-ray therapy through four ports of 150 square cm., at 200 kv., 0.5 cm. copper filter, is given for a total air dose of 1,750 to 2,250 r. The authors prefer to give roentgen irradiation before radium therapy is instituted, but this is not always possible. When radium precedes x-ray therapy, an antibiotic powder is insufflated into the vagina for two days before treatment to lessen infection. Lateral ports and intravaginal therapy have been tried and abandoned.

The over-all five-year salvage in this group was 43.2 per cent. This is an increase of 16 per cent over a similar series treated from 1926 to 1933.

Seven tables.

HARVEY J. THOMPSON, JR., M.D.
Jefferson Medical College

Treatment of Cancer of the Cervix by Radium and Deep X-Rays. Experience at the Rhode Island Hospital, 1933–1943. George W. Waterman and Sumner I. Raphael. New England J. Med. **242:** 689–691, May 4, 1950.

This paper presents the results of treatment in carcinoma of the cervix at the Rhode Island Hospital from 1933 through 1943: records of 432 consecutive cases of carcinoma of the cervix were found in the files for this period, but for various reasons only 417 were treated.

Radium treatment is based upon the use of multiple low-intensity platinum-filtered radium needles (see Radiology **49:** 411, 1947) over a long period of time. The placing of the needles about the cervix is determined by palpation. A 20-mg. platinum capsule is also placed in the cervical canal. Deep x-ray therapy is given in Stage I and some Stage II cases about eight weeks after the radium treatment. In some patients with Stage III or IV lesions x-ray therapy precedes radium treatment.

The League of Nations classification was used in all instances. Of the 417 cases treated, 34 per cent were Stage I; 50 per cent were Stage II; 10 per cent were Stage III; 6 per cent were Stage IV.

The five-year survival rate for the entire group was 40.7 per cent (170 patients); for Stage I cases 70 per cent; Stage II, 33.2 per cent; Stage III, 7.3 per cent. In Stage IV there were no five-year survivors.

The survival rate at ten years for 229 cases treated between 1932 and 1938 was 56 per cent, as against a five-year survival of 66 per cent in the same group. In Stage II there was a 25 per cent ten-year survival rate (30 per cent five-year survival rate). In Stage III there were no ten-year survivals although 5 per cent had survived five years.

The high percentage of early cases of carcinoma treated at the Rhode Island Hospital, the authors believe, can be attributed to the education of the public and the physicians in their area, since a review of all cases of carcinoma of the cervix seen since the inception of the Gynecologic Tumor Clinic in 1922 showed a gradual but persistent decrease in the number of advanced cases and corresponding increase in the number of early cases.

Two charts; 2 tables.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Wilms' Tumor. John M. Pace. Texas State J. Med. **46:** 253–257, April 1950.

Wilms' tumor is the most common abdominal tumor encountered in infants and children. Cabot was of the opinion that the odds in favor of any abdominal tumor in infants being renal in origin were ten to one.

The pyelographic defect is primarily due to compression of the renal pelvis, or complete obliteration of the pelvis with irregular streaks of the medium at the periphery of the tumor. In some instances no dye is seen.

The tumor is extremely radiosensitive, and a rapid reduction in size following irradiation increases its operability. There is no disagreement as to the need for surgery and postoperative roentgen therapy.

Two cases are reported, in both of which preoperative and postoperative roentgen therapy was given. One of the patients is still alive after twelve years. The other died with pulmonary metastases.

Six illustrations, including 1 roentgenogram.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

An Analysis of Fifty-Nine Cases of Osteogenic Sarcoma with Survival for Five Years or More. Bradley L. Coley and Charles C. Harrold, Jr. J. Bone & Joint Surg. **32-A:** 307–310, April 1950.

Among 252 definitely proved cases of osteogenic sarcoma, including chondrosarcoma and fibrosarcoma, seen at the Memorial Hospital, New York, from 1917 to 1943, there were 59 five-year survivals. A study was undertaken to determine what factors contributed to the survival—whether the treatment, the type of

tumor, or the grade of malignancy was the important factor. It was found that the prognosis in some types of tumor was distinctly better than in others. Fibrosarcoma and chondrosarcoma accounted for about two-thirds of the five-year survivals, true osteogenic sarcoma for 27 per cent, and telangiectatic osteogenic sarcoma for only 3.4 per cent. The clinical impression that fibrosarcoma and chondrosarcoma have a tendency to later metastasis than true osteogenic sarcoma seemed to be confirmed. The authors believe that the microscopic appearance of the tissue affords the most reliable index of the rapidity of tumor growth and tendency to early or late metastasis.

The majority of patients surviving five years were treated by surgery. Two cases of fibrosarcoma were treated by irradiation alone. A single patient received both irradiation and toxins. Many of those surviving after amputation had received irradiation preoperatively, and it is not known just what role this played in survival. A series now under study in which no irradiation was given will furnish a basis for comparison. The use of toxins postoperatively has been abandoned. There were no five-year survivals when the tumor was located in the proximal end of the femur.

A survival of five years is not a critical test of cure, since recurrence was found in this group after six to fourteen years. It may be concluded, however, that if a patient does survive for five years he has a 12 to 1 chance of escaping further evidence of this disease. Lobectomy for pulmonary metastasis was done in 2 cases in the series and it is believed to have a definite place in the treatment of osteogenic sarcoma.

Four tables.

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Subacute Thyroiditis. George Crile, Jr., and Eugene W. Rumsey. J. A. M. A. **142:** 458–462, Feb. 18, 1950.

Subacute thyroiditis is an acute or chronic self-limiting inflammation of the thyroid gland, probably caused by a virus, and prolonged by a granulomatous reaction to displaced or perverted colloid.

Two rough clinical categories are recognized: (1) an acute fulminating type, with exquisite tenderness, fever, and systemic symptoms; (2) the chronic type, with little if any fever, slight pain and tenderness, and few systemic manifestations. Pathologically, and in response to roentgen therapy, these two types are identical.

Because the disease is self-limiting, and because the symptoms respond specifically to roentgen therapy, it is important to recognize it to avoid thyroidectomy. A sore throat, dysphagia, and exquisite tenderness of the thyroid characterize the onset. Most patients will remember that they had pain on swallowing early in the course of their illness. Usually the thyroid is enlarged to once and a half or twice its normal size and is readily palpable because of its hardness. In chronic cases tenderness may be absent, but the patient will recall that there was tenderness at the onset. The sedimentation rate is always greatly elevated. In questionable cases the diagnosis may be confirmed by a needle biopsy.

At the Cleveland Clinic results have been consistently good with roentgen therapy. Thirty-five patients were treated with total dosages ranging from 250 to 2,000 r, averaging 800 r, given in daily doses of 100 to 150 r. The response to treatment was uniformly good, and usually dramatic. Many patients were completely relieved of pain after the first or second treatment. It took an average of thirteen days for the symptoms to subside. It appears that irradiation in excess of 1,500 r may cause some impairment of the thyroid function, but there has been no evidence of hypothyroidism in any patient treated with the usual dosages of 600 to 800 r.

Five illustrations; 3 tables.

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Cystic Hygroma of the Neck and Mediastinum Successfully Treated by Roentgen Rays. George E. Pfahler and Henry H. Perlman. Am. J. Roentgenol. **63:** 539–544, April 1950.

The authors quote Figi (Am. J. Roentgenol. **21:** 473, 1929) as stating that only 13 cases of cystic hygromas of the neck in infants and children were seen in the Mayo Clinic in ten years, and only 1 of these was found suitable for surgery, thus indicating pretty definitely that another form of treatment must be found. All writers seem to agree that if the disease has invaded the mediastinum, surgery is excluded. Figi used radium and his technic is outlined here. Hodges, Snead, and Berger (Am. J. Roentgenol. **42:** 551, 1939) treated 7 cases with roentgen rays and Portmann (Cleveland Clin. Quart. **12:** 98, 1945) has also used roentgen irradiation. The experience of these workers is given in some detail.

The authors believe that roentgen therapy should be given the first consideration in treatment of cystic hygroma and feel that it offers definite advantages over radium, for the following reasons: (1) The roentgen rays can be directed precisely to the site at which they are desired and the surrounding tissue can be almost completely protected. (2) Because of the distance factor (50 cm.), a greater depth dose, and at the same time a relatively similar effect in all the tumor tissues, is obtained. (3) Roentgen rays are more widely available and more radiologists are familiar with the technic, especially for deep-seated tissues.

A case is reported, with mediastinal invasion, in which an excellent result was obtained.

Two roentgenograms; 2 photographs.

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X-Ray Treatment of Perineal Inflammation in the Puerperium. F. Szellö. J. Obst. & Gynaec. Brit. Emp. **57:** 246–247, April 1950.

The satisfactory results obtained with roentgen therapy in acute mastitis led the author to apply the same treatment in acute perineal infiltration following spontaneous rupture or episiotomy. In 5 patients irradiation was started within twenty-four hours after the appearance of symptoms and signs; in 5 other patients treatment was not begun until the second twenty-four hours, and in 2 symptoms had persisted for longer than forty-eight hours. In 5 patients forceps had been employed in addition to episiotomy and suture.

In 4 of the cases irradiated within twenty-four hours and 3 of the cases irradiated during the second twenty-four hours, a single irradiation proved to be sufficient; in the remainder a second treatment was necessary. Technical factors were as follows: 80–100 kv., 10 ma., 3 mm. aluminum filter, 30 cm. focal-skin distance, 60–100 r to the skin per treatment. Irradiation was so administered that the ovaries were completely outside

the range of the direct rays. Care was taken to give smaller doses to cases showing rapid extension of the inflammatory process. In all patients treated within forty-eight hours the perineal wound healed by primary union and no sign of secondary infection remained. In 2 patients treated at a later stage the pathologic changes disappeared within a few days and the dehiscence remained only superficial. The duration of hospital care in the patients receiving x-ray therapy for perineal infection was no longer than in the uncomplicated case.

Recent Advances in Contact Therapy Equipment and Usage. Richard H. Chamberlain. Pennsylvania M. J. **53:** 359–362, April 1950.

Ever since 1929 research has been going forward in the use of soft or long-wave x-rays. These rays expend their energy superficially in a small volume of tissue thereby avoiding penetration of the radiation effect into the underlying tissue. The use of beryllium-window tubes has allowed the transmission of a large amount of low-energy rays, which heretofore were absorbed by the glass of the tube. With these beryllium-window tubes the voltage range has been extended from 40 to 50 kv. down to 5 kv., and the output may be as high as 2 million r per minute in comparison to a few thousand r per minute with the conventional tube.

Contact therapy is useful only in the treatment of superficial disease or lesions accessible through the body orifices or through operative exposure. The advantage over radium lies in the short period of treatment time, availability at all times, and precise control over the area covered.

The beryllium-window tubes, while having a very high output at low voltage levels, have a falling off of the dosage at the periphery when a large portal is used, but altering distance and the use of filters will give an even distribution of the rays over a selected skin surface.

A useful physical concept in choosing the penetrating quality of x-rays for clinical use is the expression of the depth in tissue at which the dose is reduced to one-half of the surface value. This is obtained by means of tissue equivalent phantoms.

Excellent results have been obtained with these soft rays in malignant lesions on exposed surfaces, with a minimum amount of cosmetic deformity. Radioresistant lesions, such as malignant melanomas, should not be treated by soft rays, as they do not respond any better than they do to higher voltages. For basal-cell epitheliomas curative doses range from 8,000 to 10,000 r. Large tumors may be treated through multiple ports.

The utilization of depth control allows more irradiation of hemangiomas with less injury to the underlying tissue, and excellent results have been seen in the cavernous type of lesion.

The beryllium-window tube has also been used in research. Barclay and his co-workers succeeded in demonstrating the arteriolar circulation of the stomach and kidney, showing the existence of shunt mechanisms, by injecting the vessels with radiopaque substances and taking a film with very low power. Marinelli and his associates were able to show the distribution of total iodine in very thin microscopic sections with a tube window of 0.1 mm. thickness.

Five illustrations.

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Use of Wedge Filters in X-Ray Therapy. Frank Ellis, W. Shanks, L. A. W. Kemp, and R. Oliver. J. Faculty Radiologists **1:** 231–244, April 1950.

The authors begin with the premise that a tumor and the immediately surrounding tissue, which may contain tumor cells, should receive uniform radiation throughout. It also seems advisable to minimize the volume of tissue treated so that regions beyond the tumor area are subjected as little as possible to the influence of radiation. To accomplish this result they have devised the wedge filter technic.

Essentially, the wedge consists of a non-uniform metal filter whose thickness varies in one direction across the field. These wedges are in varying sizes from 5 × 5 cm. to 10 × 15 cm. Larger fields do not seem advisable. Two 90° wedge fields, two oblique wedge fields with a normal field between, and two opposing wedge fields with a normal field between are the various combinations that have been used to produce a homogeneous distribution. Charts are shown to demonstrate these positions, and depth dose tables give the results.

The use of the wedge technic in the treatment of lesions of the larynx, posterior tongue, antrum and ethmoid sinuses, nose, chest, and abdominal wall, a limb, and the brain are discussed and illustrated by photographs.

Eight charts; 12 photographs.

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RADIOISOTOPES

Radioactive Isotopes in the Study of Peripheral Vascular Disease. III. Further Studies on the Circulation Index with an Evaluation of the Diagnostic and Therapeutic Value of Priscoline. Morris T. Friedell, Walter Indeck, and Fenton Schaffner. Arch. Int. Med. **85:** 667–674, April 1950.

In Part I of their study of the peripheral circulation with radioactive phosphorus the authors calculated a "circulatory index" from the rate of diffusion of the intravenously injected isotope into the lower extremity (Friedell *et al.:* Arch. Int. Med. **83:** 608, 1949. Abst. in Radiology **54:** 799, 1950). This index can be altered by subjecting the patient to treatment directed at producing vasodilatation, and such alteration is held to be indicative of response of the capillary bed. Depending on the change in the index, patients are placed in four categories. These are described and the relationships of the alterations in the index to prognosis of peripheral vascular states on a clinical basis are considered in Part II of the study (Schaffner *et al.:* Arch. Int. Med. **83:** 620, 1949. Abst. in Radiology **54:** 799, 1950).

The present report is concerned with the use of 2-benzylimidazoline (priscoline), whose effect occurs chiefly at the termination of the sympathetic nerves in the vascular smooth vessels. Priscoline may also have a direct histamine-like effect on the smaller vessels.

The following conclusions are reached: (1) Priscoline

when administered intravenously will alter the circulatory index as determined with radioactive phosphorus. (2) The prognosis of the groups as determined with priscoline coincides with that of groups determined by other vasodilating mechanisms. (3) Priscoline is apparently more effective in conditions primarily due to interference with the blood supply. It is less effective in severe associated causalgic states. (4) Orally administered priscoline is useful in the management of certain disorders of the peripheral vascular system.

Two charts; 3 tables.

Histologic Localization of Absorbed Radioactive Iodine in Some Human Thyroid Diseases. Frederick L. Kreutzer, Earl R. Miller, Mayo H. Soley, and Stuart Lindsay. Arch. Surg. **60:** 707–720, April 1950.

The localization of I^{131} was studied in 35 patients with various types of thyroid disease, including thyrotoxicosis, nodular goiter, thyroiditis, and carcinoma. A carrier-free tracer dose, usually 250 microcuries, was given one to five days before operation and uptake was measured with a Geiger counter twenty-four hours later, over the thyroid and, if there was a possibility of metastasis, over the entire body. On an average about a fifth of the tracer dose was fixed in the gland. Following operation, the removed specimen was checked for radioactivity, and a comparison was made between stained sections and their radioautographs.

Radioiodine is taken up in the glandular tissue of the thyroid, appearing in both the acinar epithelium and the colloid. The degree of uptake tends to vary with the degree of hyperplasia in a gland undergoing the hyperplasia-involution cycle. One simple adenoma and one fetal adenoma showed small uptake of radioiodine. In thyroiditis, the uptake is small and confined to the portions of the gland least affected by the disease. Of 15 carcinomas, only 1 showed significant uptake; this was an extremely well differentiated tumor which, with pulmonary metastases, had been present twenty years and was presumably producing normal quantities of thyroid hormone. Radioiodine seems to be of limited value as the sole agent for treating thyroid cancer.

The following highly important paragraph is quoted verbatim.

"Conceivably, some preliminary treatment might render the thyroid carcinoma or the areas of metastasis more amenable to iodine uptake. Theoretically, administration of thyrotropic hormone might possibly change the character of the carcinoma and make an appreciable uptake possible by rendering it hyperplastic. In this series, a metastatic nodule on the scalp of a patient who had undergone total thyroidectomy followed by extensive radiation to the thyroid area did not take up iodine. This patient showed mild hypothyroidism clinically. Presumably, increased amounts of circulating thyrotropic hormone were present because of the lack of much functioning thyroid tissue, and still the scalp nodule had no uptake. In some cases of surgically inaccessible thyroid metastasis, uptake in the area of metastasis could possibly be increased by performing a total thyroidectomy and waiting a short interval for the expected pituitary thyrotropic response before administering therapeutic radioactive iodine. The rationale for these procedures would be based on the observation of Keating and others that the uptake of radioactive iodine could be increased by hyperplasia produced with thyrotropic hormone. Destruction of the thyroid could be done by means of radioactive iodine. After this initial treatment, the carcinoma tissue might then take up adequate radioactive iodine from a second dose and therapy could be considered. However, if the carcinoma had even small initial uptakes the thyroidectomy dose might damage it sufficiently to prevent further uptake while not checking the neoplastic growth."

[A significant and well presented study.—L. G. J.]

Seven photomicrographs, 6 radioautographs.

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A New Simple Method for Accurate Measurement of Urinary I^{131} After Tracer and Therapeutic Doses. A. Stone Freedberg, Alvin L. Ureles, Marvin VanDilla, and Mary J. McManus. J. Clin. Endocrinol. **10:** 437–446, April 1950.

A new method for the measurement of urinary I^{131} after tracer doses is described. Four platinum cathode Geiger-Müller tubes are connected in a parallel electrical circuit and arranged in a horizontal plane about the source. In the experiments described, a circle diameter of 120 cm. was used. The urinary I^{131} content is measured by determining the radiation from the entire twenty-four-hour collection of urine placed in the center of this circle. The standard of reference is a 5 to 10 c.c. aliquot of the I^{131} stock solution from which the patient's dose is taken, diluted to approximately 1,500 c.c. in a gallon jug.

The per cent urinary excretion was determined by this method in 38 persons and compared to a gamma counting method (Marinelli beaker) requiring dilution and measurement of urinary volume. The average difference between the two methods was 3.4 per cent, standard deviation 1.8. The urine volumes varied from 430 to 3,730 c.c. No relationship was found between urine volume and the per cent difference in urinary I^{131} content.

The results obtained provide experimental confirmation of the theoretic considerations which indicated the virtual freedom from absorption and geometry of the platinum cathode Geiger-Müller tubes arranged in a circle and connected in a parallel electrical circuit.

The adaptation of this method, utilizing copper screen cathode Geiger-Müller tubes, for measurement of urinary excretion following therapeutic doses is described. The advantages and limitations of the method are discussed. A minimum handling of the urine sample is required and exposure to radiation is limited.

Four figures; 3 tables.

Tracer Studies of the Urinary Excretion of Radioactive Mercury Following Oral Administration of a Mercurial Diuretic. William J. Overman, William H. Gordon, Jr., and G. E. Burch. Circulation **1:** 496–501, April 1950.

By means of tracer methods the absorption, blood concentration, and urinary excretion of mercury following oral administration of standardized single doses of plain and enteric-coated capsules of a mercurial diuretic (mercuhydrin) were studied in 22 control subjects and in 5 subjects with chronic congestive heart failure.

Enteric coating of the capsules resulted in the lowest blood concentrations and in the poorest urinary ex-

cretion of mercury, which indicates that maximum absorption occurred high in the gastro-intestinal tract. Even with the more efficient plain gelatin capsules the blood concentration was low compared with intravenous administration, and the amount excreted in the urine averaged only 5.0 per cent of the amount administered orally. The addition of ascorbic acid had no significant influence on urinary excretion.

In one subject with chronic glomerulonephritis prolonged retention of mercury was demonstrated, indicating the possibility of a cumulative effect of repeated doses in patients with this disease.

The observations of poor absorption, low blood concentration, and low urinary excretion of mercury following oral administration of this mercurial diuretic precludes its general use in the treatment of congestive heart failure.

Five graphs; 1 table.

EFFECTS OF IRRADIATION

Spindle Cell Epidermoid Carcinoma. Report of Five Cases in Patients Who Had Never Been Exposed to Roentgen Rays. Maurice J. Strauss. Arch. Dermat. & Syph. **61:** 633–645, April 1950.

It has been stated by various writers—most recently by Sims and Kirsch (Arch. Dermat. & Syph. **57:** 63, 1948. Abst. in Radiology **51:** 766, 1948)—that spindle-cell epidermoid carcinoma occurs in epithelium damaged by chronic radiodermatitis. The author has seen personally 2 cases of this type of neoplasm in patients who had never been exposed to either roentgen or radium radiation, and has found 3 others in the records of the New Haven Hospital. These 5 cases are reported, and it is suggested that compression acting at the tumor site may be the important factor in the development of these lesions.

Nine photomicrographs; 2 photographs.

Ocular Lesions Induced by Acute Exposure of the Whole Body of Newborn Mice to Roentgen Radiation. Egon Lorenz and Thelma B. Dunn. Arch. Ophth. **43:** 742–749, April 1950.

Twenty-four male and 32 female mice of strain A were given a single dose of 400 r to the whole body at birth. Prior to the date on which the experiment was terminated, twelve months after irradiation, 8 males and 12 females of the experimental animals died, most of them of leukemia induced by irradiation. No instance of leukemia was observed at autopsy in the irradiated animals surviving twelve months. Five male and 1 female mouse of the non-irradiated controls died prior to the termination of the experiment. Only 1 mouse with leukemia was found in the control series.

All irradiated mice surviving to twelve months showed lesions in one or both eyes. These lesions consisted of opacity of the lens, partial opacity and vascularization of the cornea, and atrophy of the retina, which was only a small fraction of its normal thickness.

The difference in radiosensitivity of the eye of young and that of old animals is discussed.

Seven figures.

Effect of Transplantation of Bone Marrow into Irradiated Animals. Paul E. Rekers, Molly P. Coulter, and Stafford L. Warren. Arch. Surg. **60:** 635–667, April 1950.

Experiments to show the effect of transplanting bone marrow following irradiation were performed on a group of dogs. The dose of radiation given to most was 350 r over the whole body, which proved lethal in 67 per cent of a control group. A few experiments were run on unirradiated dogs and on dogs given radiation locally to the proposed site of implantation. Marrow was implanted in one of five different ways, namely (1) a simple suspension of marrow in saline, into the medullary cavity; (2) a bone button implant with attached marrow; (3) a rib transplant; (4) a suspension of marrow stimulated by multiple preliminary bleedings; (5) fragment transplants to the anterior chamber of the eye or elsewhere. The conclusions drawn are based on a thorough clinical and pathological study of some 60 dogs.

Intramedullary transplantation of normal marrow was found to be without benefit to the irradiated dog; intramedullary bleeding resulted, with subsequent organization and fibrosis. A button transplant of bone plus marrow resulted in death and replacement of the graft, any new marrow being formed by the host tissues. Transplantation of marrow to the spleen or liver was without benefit, and only the fatty tissues of the marrow persisted. Stimulated marrow suspension injected intravenously led to formation of multiple bone spicules in the pulmonary veins of the lungs; this procedure reduced the mortality from 67 to 43 per cent, which was thought to be significant. The white cell count, absolute lymphocyte count, and reticulocyte count all were higher in animals so treated.

The surgical procedure put an added load on the operated animal, but there was no evidence of inhibition of callus formation or subsequent bone growth. In attempting to explain the findings, the inability to transplant marrow successfully could not be attributed to lack of demand on the part of the host. No reduction of tissue sensitivity could be shown following irradiation of the donor and/or host, or following passage through culture media, nor were the tissues made more acceptable for "takes." Extramedullary transplantation of marrow led to heterotopic bone formation. The transplantation of embryonal hematopoietic tissues failed to alter the irradiation intoxication of the host; in unirradiated controls, examination after sixty days showed the development of cartilage, bone, and marrow in the transplant.

Fourteen photomicrographs; 5 tables; 7 charts.

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